AMERICAN MACHINIST

January 10, 1940

For Defense—*New carriages give greater mobility and increased range to the 75-mm. guns modernized at the Rock Island Arsenal (page 1)*

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McGraw-Hill Publishing Company, Inc.

Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 68 Post Street; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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VOLUME 84 — NUMBER 1

AMERICAN MACHINIST. Copyright 1940 by McGraw-Hill Publishing Co., Inc. Published every other Wednesday, price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3.00 a year. All other countries (except Europe and British possessions in Eastern Hemisphere), $6.00 a year or 36 shillings. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

A McGRAW-HILL PUBLICATION

PRINTED IN U.S.A.

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Almost 1200 items—an all-time high—will be described in the Shop Equipment Review section of your next copy of American Machinist—the annual Buyer's Reference Number. That's 25% more information, a bigger and broader handbook of metal-working equipment and supplies than ever before.

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WHAT'S IN THIS ISSUE

GUNS are being turned out faster than ever these days. But just as important as the production of new units is the modernization of the old ones. French 75's, for instance, which have long been standbys with the artillery, are greatly improved by being mounted on redesigned carriages. On page one an article with plenty of pictures shows how these new carriages are being made at Rock Island Arsenal.

LAPPING is finding increased uses in finishing parts for the metal-working industry. With the rising importance of metallurgy and its accompanying microscopic examination of specimens, lapping has become a vital necessity in preparing these parts for observation. H. J. Wills concludes his series on lapping by discussing this particular application on page 5.

A. M. SWIGERT

SUPERFINISHING has steadily progressed since its first mass-production application some two years ago. Chrysler's Superfinishing process has been further refined to give the best combination of stone, speed and multi-motion. These and other recent improvements are discussed by A. M. Swigert in an abstract from the manuscript of a book to be published in the near future. The story's on page 8.

STAMPINGS WITHOUT DIES would really be something. On short runs especially they'd be the answer to many a production man's prayer. Contour sawing, while not producing bona fide stampings, gets about the same results at a fraction of usual die costs. On page 15 George A. Heinemann tells about the applications and economics of this recently perfected metal-working process.

THROWING AWAY METAL is usually just waste. But Buick, in making engine tappets, has found it's cheaper to drill out 60 per cent of the metal in a machined slug than to use a cored casting. Details are on page 16.

PUNCHING NARROW SLOTS is a tricky job at best, but when the material is cold-rolled steel half as thick as the width of the slots, somebody's got a problem on his hands. And when the finished piece has to have eye appeal, he's likely to evade the issue by resorting to another method of manufacture. But when the price becomes important too, he punches them—successfully. How this particular punching problem was solved is revealed by Mark Golden on page 18.

MACHINING takes power. How much? Only too often nobody seems to know. On page 23 Paul H. Miller discusses power requirements for various metal-cutting operations, and gives formulas and data on numerous materials. They're tabulated in a handy reference book sheet you'll want to keep.

IDEAS are the life blood of any organization. One of the most valuable places for them is in the shop, put to practical use. On page 20 men who've made ideas click in all kinds of shops pass some of them along.

HEAT-TREATING long ago outgrew the stage of "heat to a cherry red, then quench." Specialized steel alloys and precise control of operations have combined to make the process as accurate and scientific as laboratory procedure. But often the exact hardening temperature for a given steel is different from the average value ordinarily used. For best results, information provided by dilatometer readings helps immensely. Stanley P. Rockwell discusses the technique on page 12.

STANLEY P. ROCKWELL

FOREMEN often have to combine the characteristics of Thomas Edison, Dale Carnegie and Adolph Hitler. For handling men requires, in addition to technical ability, leadership of a high order. On page 6 J. J. Phillips gives some down-to-earth tips on judging leadership qualities, selecting men, and handling grievances.

COMING

January 24 is the date when the annual Buyers' Reference Number of *American Machinist* again comes to you. This year it's brand new from cover to cover, with large photographs and streamlined descriptions of the new and improved equipment and materials made available to the metal-working industry during 1939.

The issue will contain descriptions of 1171 separate items—an all-time high for *American Machinist,* and, we feel, the largest number ever included in any magazine serving the metal-working industry. To save your time, all equipment will be classified into 7 major divisions and 71 subdivisions. For us, it represents a year's work. For you, the most complete compilation of *new* machinery ever brought together. Look for it!

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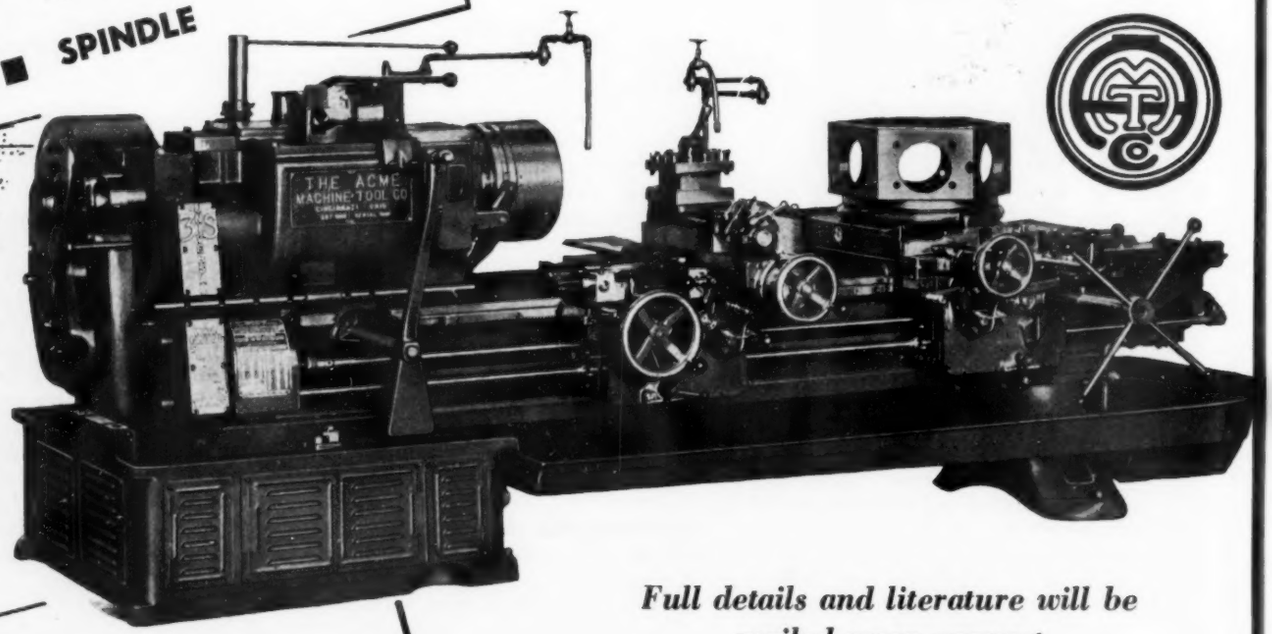

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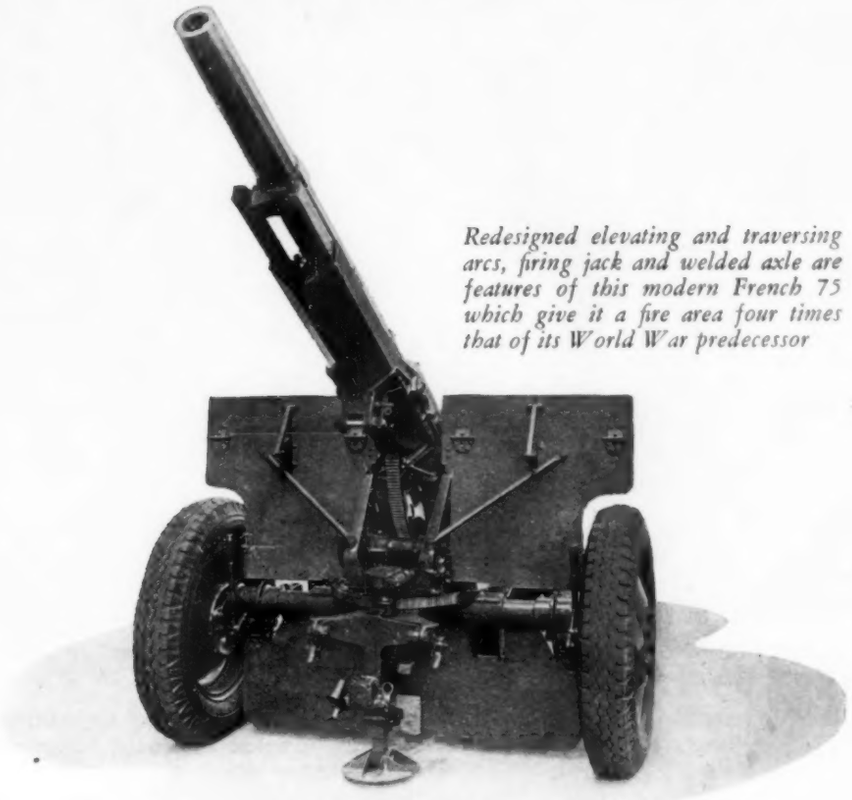


Redesigned elevating and traversing arcs, firing jack and welded axle are features of this modern French 75 which give it a fire area four times that of its World War predecessor

New Power to Old Guns

Fire area of French 75's is increased by mounting them on redesigned carriages. New machines at Rock Island Arsenal speed the modernization of these artillery units

DURING the World War the French 75-mm. gun was one of the most effective artillery pieces. Many of them are still in use, but like so many other machines more is demanded of them today. By putting the recoil mechanism and gun on a modern carriage, vertical and transverse movements have been increased to such an extent that it will now effectively cover three to four times the area formerly possible.

This has been accomplished by mounting the gun and recoil mechanism on a sub-carriage, with a trunnion placed farther aft to allow more elevation; the former single trail has been replaced by a split trail. The completely new carriage is made of the following major parts: the axle, which consists of two large tubes with welded fittings and a bolted traversing ring; the split trail, which is made up of two welded box sections with welded fittings; the top carriage, which is a welded box-type structure supporting the gun trunnions, housing the equalizing cylinders and supporting the gun elevating parts; the firing jack, which is a cast structure for supporting the gun when in firing position, and for taking the weight of the gun from the equalizing springs during travel; the sub-carriage, which is a formed and welded sheet-steel part fitted to the original 75-mm. recoil mechanism. In addition, the gun barrel is stripped down and one large forged and two welded steel bands are placed around the gun. Two rectangular steel and bronze slides are attached to the bands for bearing surfaces in the recoil mechanism slide.

Most of the major sub-assemblies on the 75-mm. gun carriage are welded parts. They consist of combinations of forgings and steel plate, in some cases castings and steel plate, and sometimes combinations of all three forms. Weight is one important factor in a gun and that combination which will give the maximum strength-weight ratio is used. Welding practice is well controlled and distortion is kept at a minimum; thus less allowance has to be made for machining welded sections. Plate thickness is selected according to desired strength and not according to some large tolerance required in

Assembly line at Rock Island Arsenal, showing split trail, top gun carriage with trunnion, sub-carriage and rebuilt recoil mechanism of 75-mm. gun installed in foreground. Axles on horses at right are of welded construction

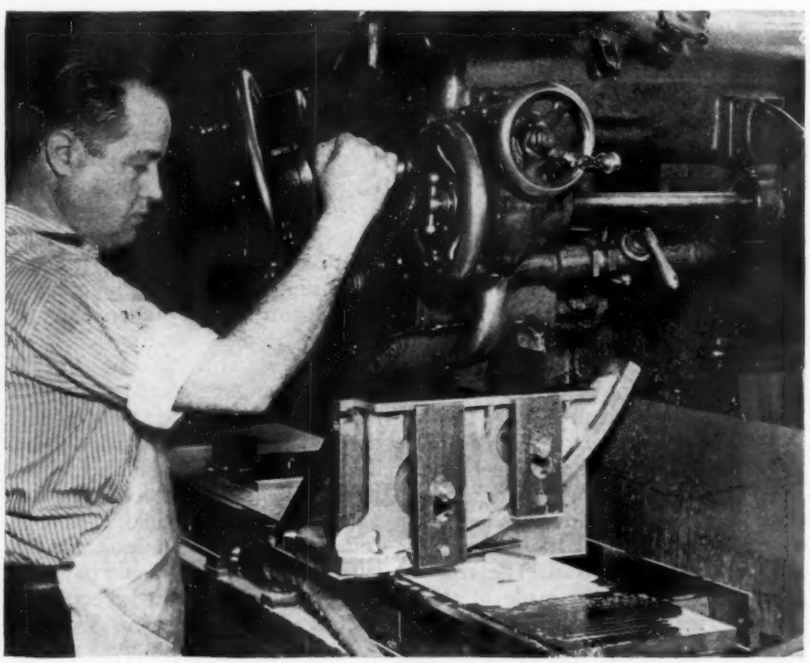
machining parts distorted in welding.

Plates are either machine flame cut or formed by nibblers or shears. In those cases where it is not desirable to remove flame-cut edges by grinding, the pieces are cut to exact dimensions for welding in one of two Savage nibblers. One of these has a turret head having a capacity of $\frac{3}{8}$" in. mild steel; the other has a capacity of $\frac{5}{8}$" in. mild steel with a mechanical feed.

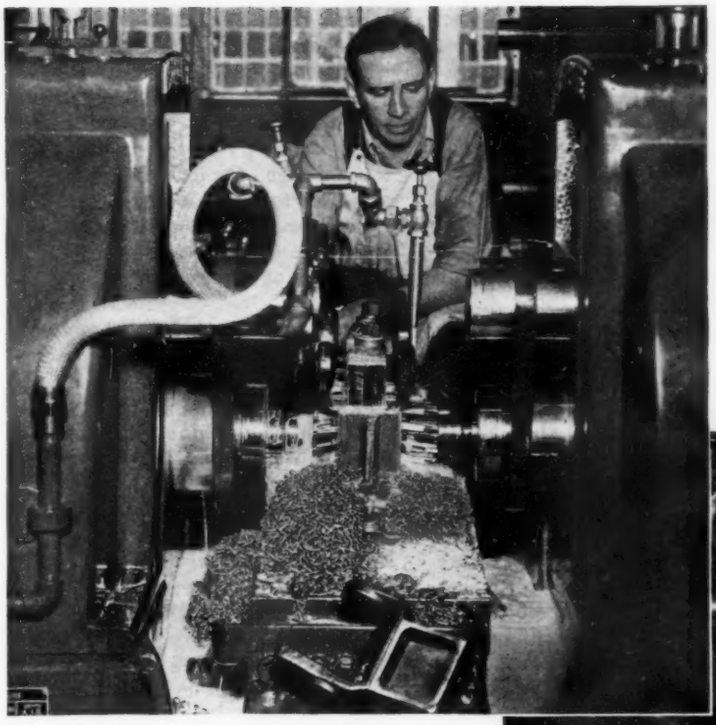
The split trail is made of two channel-shaped sheet sections which have been formed in a drawing press. They are welded together in a continuous seam automatic welder. After the machined hinge fittings and spades have been welded in place, a master fixture locates the brackets at the spade end. This fixture is equipped with both a master left- and right-hand trail so that in every case all parts are located from one or the other masters, thus making every trail section interchangeable.

The top gun carriage is made of several welded sub-assemblies. High-tensile $\frac{3}{16}$-in. steel plate is used while main bearings points such as the trunnions are welded-in steel forgings. These are finished machined after final stress relieving of the complete welded assembly. In building up sections of this type, the proper welding sequences are determined on the first piece to eliminate or minimize distortion in later production operations. The welder uses positioners to reduce distortion; these place the work properly for effective and proper welding sequences so that one part will not pull another out of shape. The welding shop is equipped with six Ransome 1,000-lb. positioners and four United Engineering 2,000-lb. positioners.

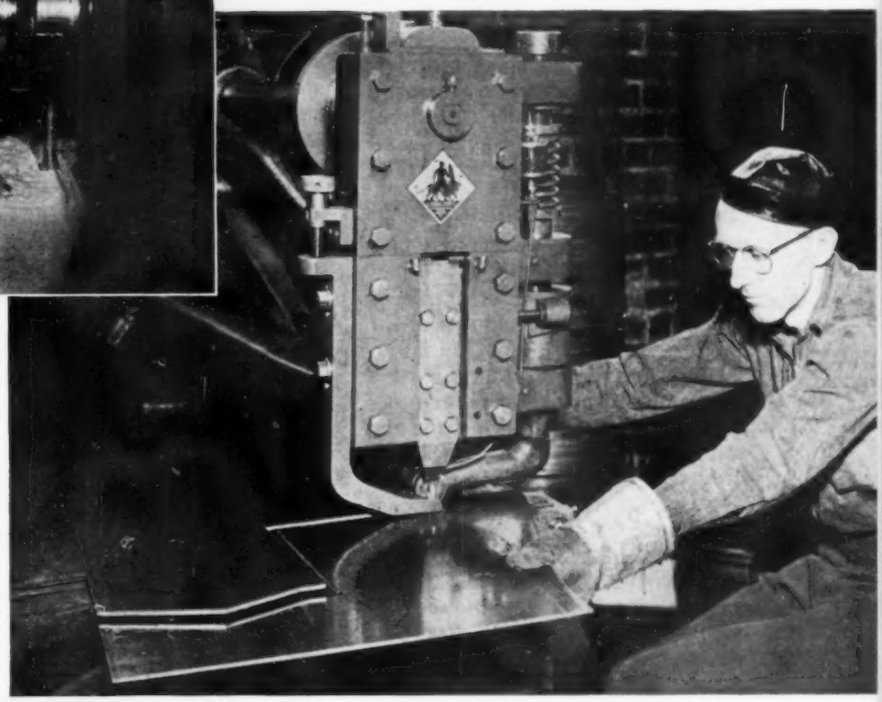
Distortion is also eliminated by building up all major parts from smaller welded sub-assemblies. It is possible to straighten the sub-assemblies easily prior to fabricating into larger parts. When a welding sequence has been established, it is desirable to let the first weld cool before welding another section. Tie bars are used during the welding process to



After milling, a few thousandths are ground off the bedding surface of the elevating arc to make it absolutely square for locating in a gear-hobbing fixture. The elevating arc is welded steel plate, the curved section of which is turned in a Bullard vertical turret lathe prior to welding



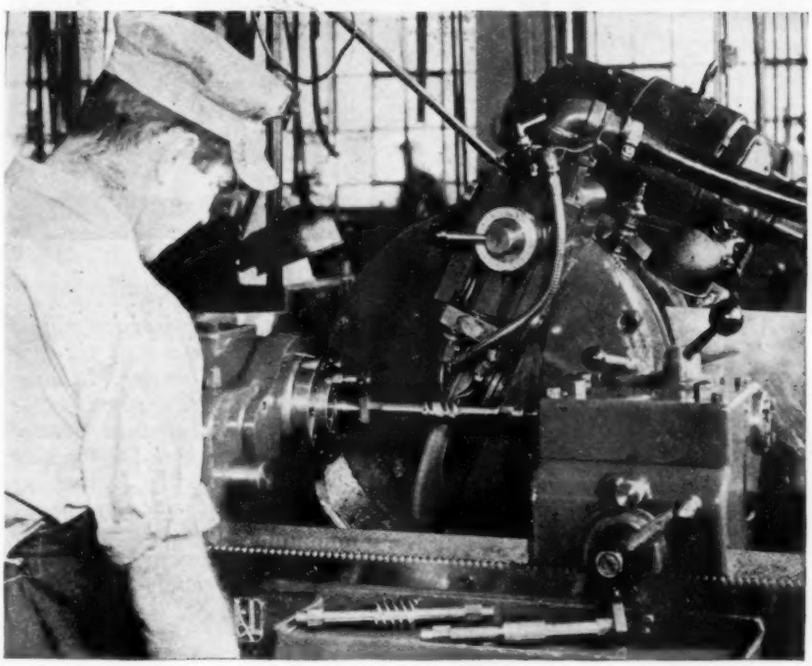
Milwaukee duplex milling machines are used on many of the 75-mm. gun carriage parts. The forging in the foreground is being milled here in groups of three with sequence of rapid approach to first part, feed across first part, rapid approach to second part, feed across second part and so on. About $\frac{1}{8}$–$\frac{5}{16}$ in. of metal is removed from each side of the forging which is finished in one pass of high-speed steel cutters feeding at $1\frac{1}{2}$ in. per minute



hold parts in place and they are left in during the stress-relieving cycle in the furnace.

It has been found that production can be increased and quality of finished work improved by having second- or third-class welders do only tack welding and having the first-class welders do the final welding work.

At the present time, d.c. current is supplied by a 1,500-amp. d.c. conversion unit. Whenever auxiliary power is needed eighteen portable welders



Side plates for the top carriage are cut to dimension from steel plate in mechanical feed nibblers. They are used where it is desired to cut directly to dimension for welding without recourse to grinding which is sometimes required after flame cutting

Quadruple-thread elevating worm is ground from the solid steel piece shown on the tray in about $1\frac{1}{2}$ min. Improved grinding wheel life and good production is secured by grinding in both directions of table travel. Three of these machines are located in the tool reclamation department where they are also used for production threading as well as grinding taps and other tools

are available. The converter feeds the current through Wilson panels for individual control of the current in each welding booth. However, a.c. current is available for all multiple-pass welding, transformer-type welders being used for sections ½ in. or more in thickness.

The inspection procedure in the welding shop after shot blasting and prior to stress relieving consists of visual inspection, Magnaflux inspection and X-ray inspection.

Magnaflux equipment includes a 3,000-amp. a.c. transformer which is used to supply an average of 600 amp. for continuous production work. For intermittent duty and smaller jobs a 300-amp. d.c. welding current generator supplies necessary magnetizing current. Red iron powder is used because it stands out more clearly against the shot-blasted surface than would black powder.

If there are no major defects all welded parts are stress-relieved in a re-circulating type gas-fired Surface Combustion car-bottom furnace. Parts are heated to 1,150 F. and soaked for one hour for each inch of thickness.

After stress relieving the parts are Magnafluxed again. Any minor defects in the weld are cut out and the part rewelded; such small areas are stress relieved by peening. Peening is also used for stress relieving between passes in multiple-pass welding.

A General Electric shock-proof jib-crane type 220,000-volt X-ray machine is being installed in the welding shop. Walls are lined with ⅛-in. lead sheet which furnishes the same amount of protection as a 12-in. concrete wall. This equipment will have a capacity of 3 in. thickness in steel and will be used to check important welds before parts go into the stress-relieving furnace.

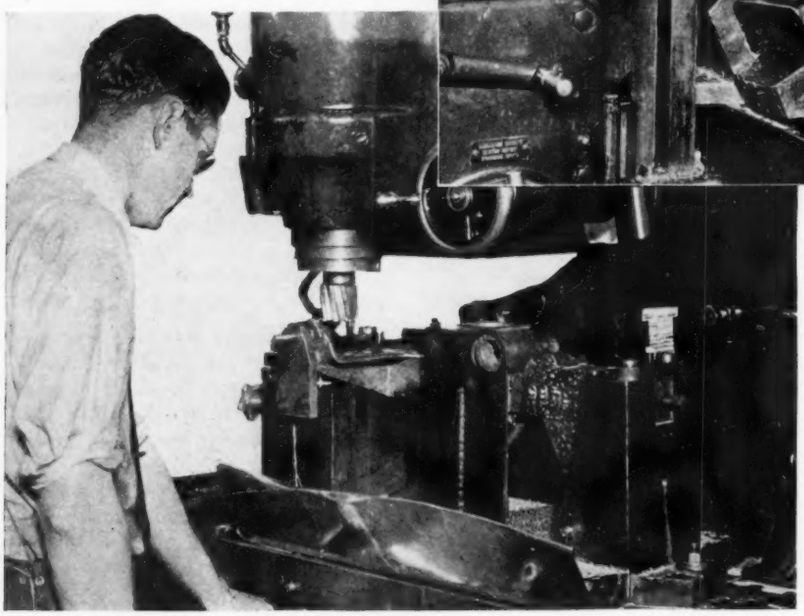
Recoil mechanisms are being reconditioned as a part of the job on this gun. This consists primarily of refinishing the cylinder bores and the piston rods preparatory to fitting new packings. The important requirement in this work is to have absolutely straight bores. Illustrations show methods used.

Grinding has been found useful at the arsenal for removing large quantities of stock in a comparatively short time. The axles of the 75-mm. gun are made of 3-in. diameter cold-drawn tubing. Cut to desired length the tubes are finished from the rough in a centerless grinder, 0.010 in. of stock being removed in one pass to a tolerance of 0.001 in. on the diameter. Other sub-assemblies, some of which are shown in the illustrations, are welded to these tubes to make the completed axle shown on the assembly line. The wheel spindles are turned from bar stock in Monarch Magnamatics with a tolerance on finish dimension of 0.001 in.

The weight of the overhanging portion of the gun is supported by springs housed in cylinders inside the top carriage. Centerless grinding is also used to machine the outside surface of the 5½-in. diameter tubes from which the cylinders are made.

Details of other machining operations on the 75-mm. gun carriage are given in the illustrations and captions. Inasmuch as the arsenal has a production problem similar to that of a large contract shop—comparatively small lots each of anything from anti-aircraft guns to tanks—all of the machines are general-purpose units; fixtures play an important part on many of the jobs.

In the past year the arsenal has been provided with money to purchase modern, faster and more accurate equipment. More is being added every month, making it a more efficient unit than ever before for modern defense.

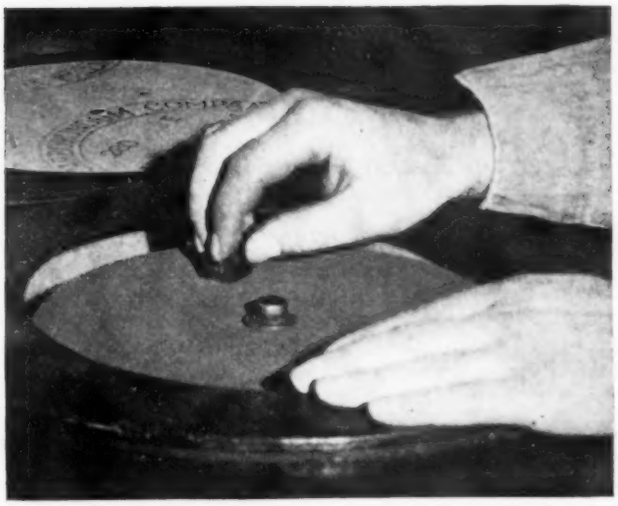


Five fixtures are required for milling all the finished surfaces on the cast-steel firing jack housing. Location pads are milled after the bore for the elevating worm has been located properly and the bore for the rack has been centered. The locking lug is milled in a stationary fixture (above) which holds the part at the proper angle according to locating points milled previously

Lapping for Final Finish

IV.—The author ends his series by telling how to prepare metallurgical specimens

By H. J. WILLS
Engineer, The Carborundum Company



For smoothing and finishing pouncing paper may be used. The dry disk method is shown

PREPARATION of metallographic specimens breaks down into three main operations—smoothing, lapping and polishing. These terms are used somewhat differently in the laboratory than in ordinary shop parlance.

The three processes can be used on specimens whose surfaces are of uniform hardness. There are, however, a large number of materials in which the lapping operation must be eliminated because the surface contains both hard and soft spots; as a result lapping will not give a level surface.

The specimen is usually rough from a break or cutting off operation. It can be smoothed with wheels or with coated belts.

By the former method, two wheels, mounted on a bench or floor type grinder, are desirable. The sides of the wheels are used. The grinding may be done dry, but the best results will be secured if the wheels and work are kept wet with soda water. The first grind is done on a 100 grit, medium hard (P grade), aluminum oxide vitrified bond wheel. After this roughing grind, the specimen is finish ground on a similar wheel of 180 grit.

If desired, these operations may be performed on an endless belt sanding machine, using 45 degree splices. For the roughing operation 180 grit aluminum oxide cloth is used, the finishing being done with the same kind of cloth in 240 grit.

The lapping and polishing operations are performed on rotating cast iron disks covered with canvas, felt or various other materials. The abrasive may be loose in the form of a powder, or a compound. If a loose abrasive powder is used, the best practice is to float it in water, usually agitating it to make certain that the grain will be fed to the disk evenly.

Compounds have several advantages over loose abrasives. They give a free but shallow cut without scratching, and are mechanically suspended in the medium so that the flow to the work is uniform without the need of mechanical agitation. While they are somewhat more expensive than loose abrasives, they are economical in the long run since they are not subject to waste by being thrown from the wheel.

There are two lapping operations for specimens of uniform hardness. Rough lapping is done with a disk covered with canvas and either a 220 grit, aluminum oxide compound in paste form, or in powder form.

Semi-finish lapping is done with a disk covered with kersey or broadcloth and a 400-grit compound of the sort used for rough lapping, or H fine aluminum oxide powder.

How Specimens Are Polished

For ordinary polishing, to follow the lapping operations, the disk is covered with kersey, broadcloth or "kitten's ear" velvet. A compound of 800-grit aluminum oxide paste may be used, or "A extra fine" buffing powder. If a high polish is required this operation is followed by one using the same compound or powder with the disk covered with chamois.

When the lapping operations are omitted, bonded wheels of special characteristics are used for smoothing, semi-finishing and finishing up the point where polishing is done. If the specimens are to be etched, polishing is not necessary. Otherwise the polishing is done as already described.

The grinders may be of the bench, floor or disk type, or may be specially built. In any type of machine the following wheels should be used:

For cast iron and the non-ferrous metals the wheels should be resinoid bond using silicon carbide abrasive. For smoothing use 80 grit, for semi-finishing 220 grit, and for finishing 500 grit.

Most steels and ores should be ground with wheels of resinoid bond and aluminum oxide abrasive, using 180 grit for smoothing, KHM grit for semi-finishing and KAM grit for finishing.

For dry grinding the speed must be kept under 1500 s.f.p.m. at the point of contact between wheel and work, but if ground wet, speeds as high as 5,000 s.f.p.m. may be used. However, low speeds are preferable.

Instead of wheels, pouncing paper may be used—8/0 for smoothing and 11/0 for finishing. Polishing is done in the usual way. The paper may be mounted on rotating disks. Some prefer to hold the paper flat on plate glass, and move the specimen back and forth by hand, occasionally changing the direction of movement to right angles with the first.

To level off the abrasive coating on the pouncing paper it is well to rub it over a corner before using.

It is important that wheels, disk or otherwise, be kept truly flat on their faces. This can be accomplished usually by holding a block of cast iron on the face of the wheel for a moment, at frequent intervals. If through carelessness the wheel faces become badly worn or grooved, they should be trued in a lathe with a diamond dressing tool.

Show your appreciation of a man's interest in his work in as many ways as you can

A foreman talks to foremen

He gives them some down-to-earth tips on the qualities of leadership, how to select the right man for the right job and how to handle grievances

By J. J. PHILLIPS
Foreman, Rates and Methods Department
Tractor Works, International Harvester Company

HANDLING MEN requires leadership—that ability to get cooperation and that inspiring force which makes men desire to do their utmost. When giving orders, a leader tempers them with consideration. He must be courteous, willing to take his share of the blame. He must notice good work as well as bad and be just in his decisions. He must be sympathetic and understanding. If he has these qualities, his men will follow him.

Leadership by force cannot endure; leadership by consent is the only route to success. A leader must set the example. He cannot expect his men to work if he loafs. He must possess both courage and confidence—courage to do what he knows is right, and confidence in his ability to judge what is right. He must practice self-control so he will have it in an emergency.

Compensation comes to the foreman not for what he knows, but for what he does with his knowledge. A good leader always has time to talk to his men. The leader who gets the big head is sure to become top heavy and to topple. A leader treats all employees the same, regardless of race, religion, nationality, lodge affiliation or politics.

The more you know about the temperament, characteristics, ambition and habits of your men, the more accurately you can select a man for a job when the need arises. In selecting men, you should keep in mind the following points:

If the man had a free choice, would he be likely to choose the same job? Will he get personal satisfaction out of his work? Does he fit in temperamentally and physically with the men he is to work with? Has he had sufficient education and experience to handle the job properly? Is the new work up to his mental level? Does the job lead in the direction of his ambitions? Will his selection for the job arouse just resentment on the part of his co-workers?

Is he punctual? Do monotonous jobs bore him into carelessness and indifference?

You should avoid running too strongly toward one nationality, clique, friends, relatives, fraternal associates or political partisans in promoting your men. You should be sincere, pick your men on merit only, and use good common sense instead of your emotions. Do not misjudge misfitness for unfitness.

Whatever you do, don't use a boy to do a man's work. In other words, don't expect first-class results if you assign a man to a job for which he is not properly fitted. Success in selecting the right man for the job can be attained by avoiding snap judgments. Don't try to fit square pegs into round holes.

THE ABILITY to teach men is the kernel of the ability to manage men. To determine what a worker is best fitted for, try him on various jobs whenever the opportunity arises. Try to train men to be more valuable. Be sure your instructions are clear, com-

plete, accurate and interesting to the man. In giving instructions, you should be patient in studying the man's capacity to understand and remember what you are telling him.

Bear in mind that your own showing depends on how well your workers understand and carry out your instructions. Training is a continuous application of teaching methods, to improve the efficiency, understanding and ability of each worker to do his job well. The training job is never done because even the well trained man can improve.

Talents are distributed by nature without regard to pedigree. It is to your credit to try to discover and develop latent talent among your men. Remember we were not born with the knowledge we now possess.

Give a man the incentive to work, to put spirit and effort into his work. A man nourishes his body with food, but seldom does he give nourishment to another man's soul which may be hungering for appreciation and open praise. Show your appreciation of a man's interest in his work in as many ways as you can. Praise often, and be loathe to find fault. A man rarely succeeds at anything unless he has fun doing it. His interest must be in his work. Encourage your men not to fret if the job is small and the rewards few; remind them that the mighty oak was once little, too. Arouse a man's interest by trying to get him to figure out ways in which the work could be done differently. The best way to relieve the monotony of a job is to think up ways of improving it.

THE TIME to adjust grievances is while they are small. Most fires could have been put out with a cup of water if applied at the right time. Careless supervision accounts for small grievances growing into ones so big that your superiors probably will have to settle them. Never put off settling a grievance until tomorrow, because then it may be too late to handle it easily.

Allowing the same grievance to occur a second time indicates an indifference on your part toward the worker's welfare. The promptness with which action is taken on grievances is an important factor in determining the worker's satisfaction or dissatisfaction. Delayed action breeds in the worker a feeling of resentment.

Before a grievance is finally settled, both sides must feel that justice has been done. Avoiding responsibility by passing the buck creates more hard feelings than it cures. Making the excuse that "it's over my head" only increases the man's feeling of futility and desperation. Don't be afraid to say "no" if that is the proper answer. To pussyfoot will only make for more trouble in the end. Do not give an answer without due consideration. If you grant the request immediately, the man may feel that you knew about it all the time and did nothing about it until he protested. If you deny the request speedily, he may feel that he isn't being given a break.

In denying a request, you should soften the blow by presenting all the reasons for your answer in a patient and considerate manner. Remember that grievances based on imaginary causes can be just as irritating to workers as those based on real causes. Though a grievance may be groundless, it should be given the same consideration as a real grievance.

A channel for the expression of individual worker's grievances should always be open. Remove at once, as far as possible, any feeling that authority will be used to force a settlement. Do not let your authority repress the free expression of grievances. When used as a club, authority begets disrespect and antagonism; used judiciously, it heightens respect and cooperation.

Haggling over details of a hair-line decision encourages a non-compromising attitude on the part of the other fellow. In any border-line decision it is wise to give the worker the benefit of the doubt. Giving a little when it is not necessary creates better relations among your workers.

If a man under you takes a grievance over your head without first discussing it with you, find out what tactics you are using that discourage him from coming to you. Dealing with one grievance may suggest to you where to look for a like grievance and how to eliminate it before the man thinks of it. Watch the effect of every move you make so you can learn to deal wisely with men.

No bargain is sound unless it benefits both sides. Many grievances are caused by a lack of knowledge of what constitutes a day's work. Discrimination against workers is the seed which grows into grievances. The most effective way of winning a man's confidence is by trying sincerely to see his side of the story. Repairing a broken promise is a good idea, but it can never be made as good as new.

The waving of the grass will tell you the way the wind is blowing. The number and seriousness of grievances in your department will tell you how well you are handling your workers' problems.

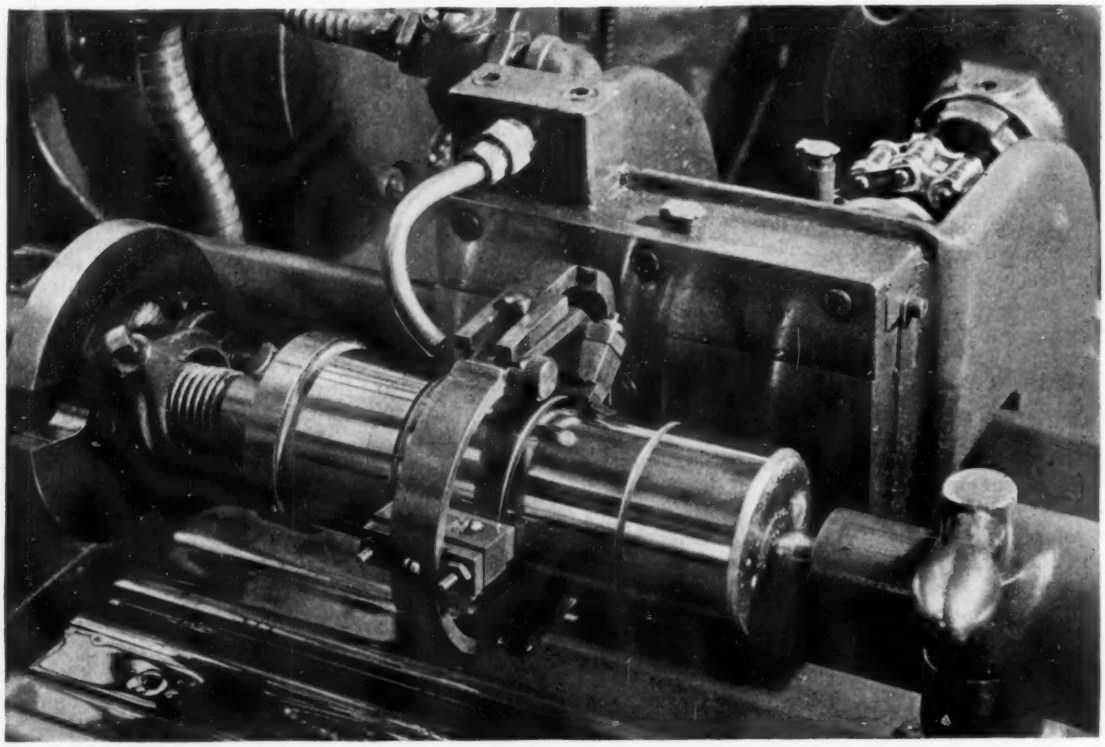
Money Makes Money—And Jobs

By J. G. HAINES

We have been attending some clinics of our local Chamber of Commerce to find out why businesses are leaving town. Business man after business man, retailer and manufacturer, got up and pointed out that the crying need in their particular case was credit. One manufacturer of venetian blinds said that he had a government order which would take a year to complete and that he would not receive his money before the end of that time. However, there is not a bank in town that will loan him the necessary money to buy the carloads of raw materials that he needs to get started. As a consequence his small plant which normally would keep ten or twelve people off of the relief rolls has had to close down.

While this fear seems to be paralyzing our regular financial channels perhaps the best solution is the one reached in Dallas, Texas. There the Chamber of Commerce did not concern itself so much in attracting new business to the town as it did in keeping what it had. It set up a financing arrangement whereby any business man who required an extension of credit to carry him through his seasonal periods could get such credit from this committee of the local association which would underwrite whatever amount was required. There is a lesson for every community—make a plan to keep what it has and then solicit new business.

What Counts Is the Finish



Superfinishing a plug gage is said to increase its life fivefold

The Superfinishing process has been further refined to give the best combination of stone, speed and multi-motion to produce a smooth surface. It is based on a theory that works

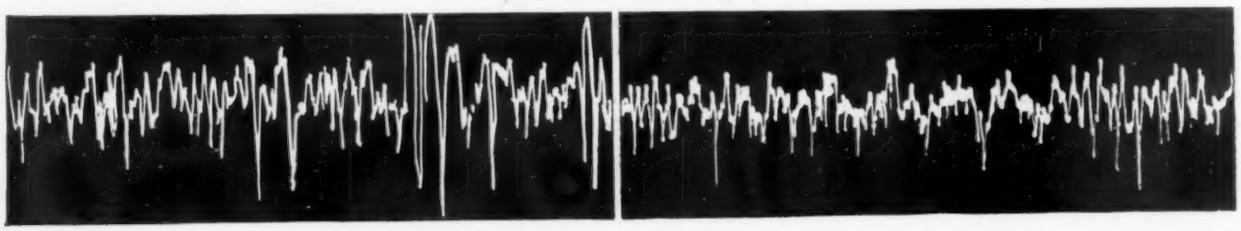
By A. M. SWIGERT
Production Research Division, Chrysler Division, Chrysler Corporation

TO A GREAT MANY PEOPLE the old phrase, "There is nothing new under the sun," appears to be a fact. In the machine tool industry, however, a resumé of methods of surface finishing shows steady improvement.

Abstracted from the manuscript of a book to be published in the near future.

Superfinishing technique uses relatively coarse bonded abrasives, a combination of short scrubbing motions, light pressures, slow abrasive cutting speeds and a fluid acting as a lubricant instead of a coolant. The resulting surface is different metallurgically and physically than surfaces produced by any other commercial machining method. Abrasive stones, held lightly against the work, move back and forth, while the work spins, revolves or oscillates in such a way that surface "teeth" or "peaks" left after grinding are scrubbed away.

Mechanical operations that are per-



formed to obtain dimensional size fragmentize the metallic surface of the part so there is left a surface that by analogy may be compared to a layer of snow upon a body of ice. The snow is of exactly the same chemical constituents as the ice but in an entirely different physical condition. Likewise a block of steel that has been finished to dimensional size will be covered with amorphous metal. This surface can be brought to a Superfinished surface with a bonded abrasive brick by removing the fragmented material leaving the smooth crystalline surface exposed.

Preparing a surface for Superfinishing requires that the final dimensional accuracy should be maintained as closely as possible in the previous operation. It will be found less expensive to correct the causes for the dimensional inaccuracies in the preliminary operations than in the Superfinishing process.

One of the basic advantages of Superfinishing is the rapidity with which rough surfaces produced by other machining methods are smoothed in a few seconds. The greater percentage of surface roughness is removed in the first five seconds of the operation. As the bearing area increases, the loaded stone and lubricant viscosity begins to take effect. This slows up material removal which insures an increasingly mild abrasive action.

Extensive tests in production and in the laboratory, have proved that other conditions being equal it is preferable to have a relatively rough surface to Superfinish instead of a fine one.

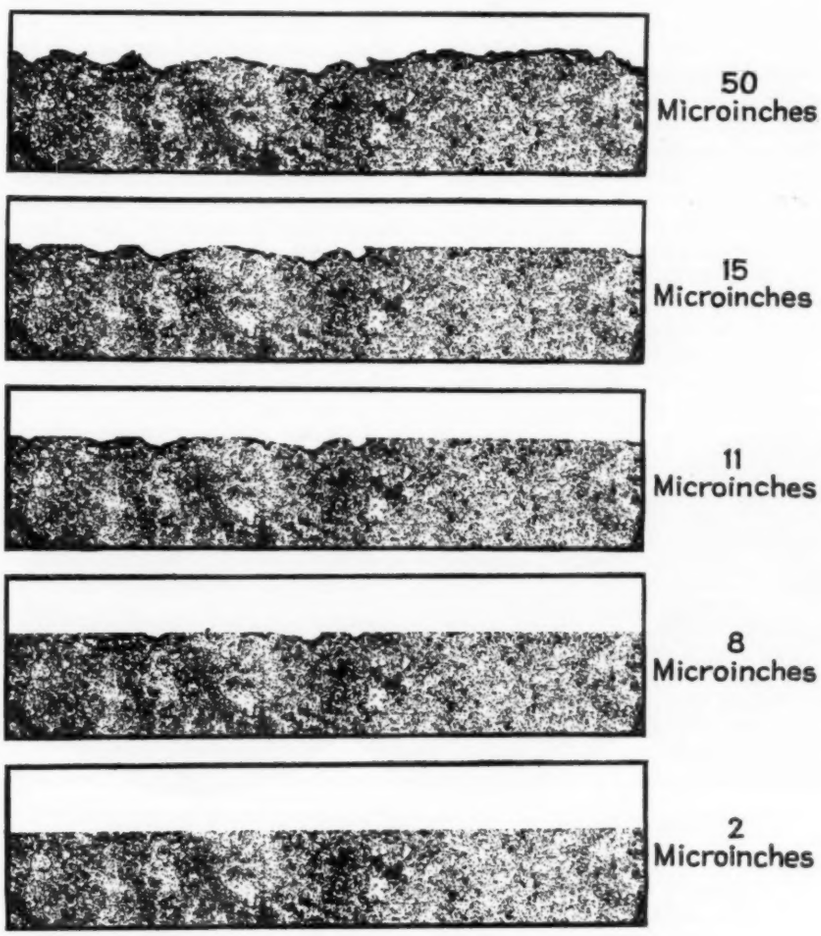
A rough surface will dress the loaded and glazed surface of the abrasive. The cycle can then be completed wherein the rough surface is smoothed, the Superfinishing stones become loaded and the bearing area of both stone and surface increases until the lubricant eliminates the cutting action of the abrasive.

The blocks are always of such surface area that once an abrasive grit has done its bit of cutting it is washed away and does not remain between the stone and the work continually producing additional scratches. Abrasive blocks are made up in the sizes best adapted to the work and can be rectangular, square, curved, cupped or in fact any shape necessary to fit the part.

All types of abrasive materials are used. Whether silicon carbide or aluminum oxide is to be used will, in general, follow the same specifications as grinding operations. This would be silicon carbide for Superfinishing low tensile materials as cast iron, aluminum, brass, bronze and other materials such as brake lining. While silicon carbide abrasives are preferable in grinding cast iron and other cast metals, for Superfinishing they do not appear to have much superiority over aluminum oxide.

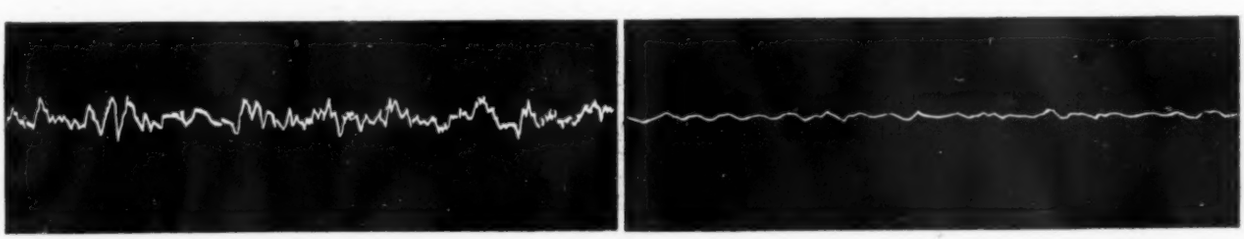
Aluminum oxide abrasives do not fracture as easily as silicon carbide so are more suitable for materials having high tensile strength, as carbon steels, alloy steels, high-speed steels, malleable iron, tough bronze and other materials of considerable hardness.

Diamond dust bonded into abrasive blocks is widely used for sharpening



Profile photomicrographs reflects the progress of the Superfinishing process. At the top is the rough surface. Views below give the surface condition after the process has run 10, 20, 25 and 30 secs.

Four Profilograph traces show the relative depth of surface scratches. Reading from left to right, the surfaces measure 13, 8, 4.3 and 1.1 microinches respectively



cemented carbide tools. For Superfinishing precision parts of great hardness, it has proved successful. Because of the rapidity at which the diamond abrasives cut, and their inherent ability to continue cutting inasmuch as the diamond particles do not readily dull, do not jerk out of the bond and do not break down readily, lubricants of high viscosity should be used with decreased surface pressure.

The grain size for Superfinishing blocks ranges from 180 to 320 for parts such as brake drums, clutch pressure plates and flywheels and 500 for crankshafts, pistons and valve stems.

For the finest of reflecting surfaces a grain size of 600 mesh is found sufficiently fine. Experiments have been made in using stones bonded with abrasives of 1,000 mesh, but so far no production operation has required this fineness.

The bond used for Superfinishing stones may be listed as follows:

Soft Steel	Vitrified
Hard steel	Vitrified
Cast Iron	Vitrified
Aluminum	Shellac

The length of stone is governed on shoulder work, such as crankpins, by the width between flanges. This length must, of course, allow for the length of oscillation.

For long bar work, the length of the stone is governed more by the size of the oscillating head and the stone holder. In general, however, stone length of greater than 6 in. is not desirable, as here again the loading action becomes more pronounced during traverse of the stone than it would were shorter stones used.

For internal Superfinishing, in which one or two stones are used, the length of stone must be carefully determined. In general, the length of stone is equal to the length of the bore, and the oscillation or reciprocation will extend the stone far enough from either side to keep the stone uniformly dressed.

The random motion used in Superfinishing can be produced either upon flat work or round work. The only difference is that flat work allows the greater advantage to be taken of multi-directional abrasive path, because abrasives working in a plane are not limited as they are in cylindrical work. This condition is largely overcome for cylindrical work by the use of several different speeds of oscillataory motion.

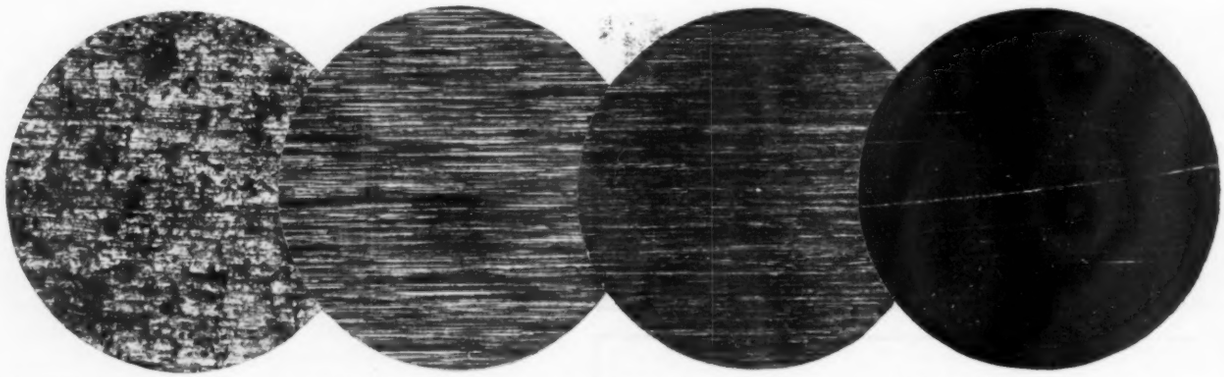
To add further to the random motion, individual grains of abrasive will have the entire head upon which the abrasive stone motions are produced can be moved sidewise, or back and forth, or swung in an arc over the entire surface. As this motion carries the stone past the center line of the work there is a complete reversal of every cutting action for each abrasive particle.

The above variety of multimotions can be transferred to any degree of random motion by varying any of the speeds to change the random path. The only way the path of an individual abrasive can be at all considered or plotted is by the law of probability.

For Superfinishing round work, using saddle-type stones in order to derive the great benefit of surface abrasive contact with the work, machines are designed and built having the following abrasive motions:

Using round figures, as an example, the abrasive stone is oscillated $\frac{1}{16}$ in. at 500 r.p.m. making 1,000 strokes per minute of $\frac{1}{16}$ in. each. The mechanism oscillating the stone at this rate is itself oscillated $\frac{1}{4}$ in. at 100 r.p.m. making a motion of 200 $\frac{1}{4}$-in. strokes. Because of the combination of the longer, slower stroke and the shorter, faster stroke, the abrasive grain must follow a path of everchanging direction at varying speeds.

If desired, the mechanism operating both of the above motions can be longitudinally moved at slow rates of speed over an appreciable distance provided the round work is of sufficient length. If an additional motion is necessary the rotating work piece can be reciprocated longitudinally while it is rotating.



Photomicrographs at 25 × magnification show respectively ***turned****, ground, lapped and Superfinished surfaces*

For soft steel parts of less than $\frac{3}{4}$-in. diameter shellac bonded stones are sometimes preferable. For soft ductile materials in which stone loading becomes a factor other bonds sometimes appear more favorable.

The number of stones to be used in a stone holder depends upon the size of the work and the rapidity with which the surface must be processed.

For small diameters, up to probably 3 in. in diameter, a single stone will produce a satisfactory operation. For larger diameters, two or more stones may be used depending upon their width. For exceptionally large diameters, such as steel mill rolls and large shafts, five or six stones may be mounted upon a single holder thus greatly cutting down the time required for large surfaces.

One of the limitations to work speed is the type of part to be rotated. As an example, a crankshaft having a long throw or one which is long and slender could not be rotated too fast without the natural flexibility in the shaft producing a certain amount of distortion. Too high a rotative speed sets up conditions which make it difficult to keep the stones applied to the crank pin portion of the work. On shafts such as this it is usually desirable to have the r.p.m. at the end of the Superfinishing cycle at a maximum speed without distorting the part.

If Superfinishing operations are done in two stages, a roughing operation with coarse grained stones and finishing with finer stones, or if a single grade of stone is used and the work r.p.m. is varied from slow at

the start of the cycle to fast at the end, the surface speed will be approximately as follows:

Roughing or beginning—
20 to 30 s.f.m.
Finishing or completing—
60 to 90 s.f.m.

If only one speed is to be used the r.p.m. of the work should be sufficient to produce 50 to 60 s.f.m.

For parts small in diameter it is sometimes difficult to obtain high enough r.p.m. to insure this surface speed. In such installations the maximum speed available should be obtained and the reciprocating speed decreased in order to give the correct helix angle.

On flat work where a round stone holder is used to which various sticks are fastened, or where a cup-type wheel is used, the rotating motion of this stone holder should be low enough so that the outside periphery of the cup stone will be below 100 s.f.m.

The primary reciprocation is the high-speed, short length cutting stroke of the abrasive. In general, the harder the material the faster should be the cycles of the reciprocator, and also the shorter should be the stroke.

The number of reciprocations per minute is limited to a certain degree by the size of the stone holder used. For a stone holder for large work in which a number of large abrasive blocks are clamped, the reciprocation will probably be limited by inertia effects to around 500 cycles per min.

If the stone holder and stone are small and light the inertia effect will be less serious and the reciprocations can be upwards of 2,500 to 3,000 cycles per min.

Superimposed upon the relatively high-speed, short stroke reciprocation, it is advantageous to have an additional reciprocation of from two or three times the stroke of the primary reciprocation and have it operate at approximately as many cycles of reciprocations per minute.

Even though the reciprocation of the stone holder appears to be rapid, when it is figured that the stroke may be only $\frac{1}{8}$ in. in length in most installations, an abrasive grit will have to reciprocate 96 times to travel one foot. If the motion is 960 strokes per min., the resulting abrasive speed will be only 10 s.f.m. This slow abrasive speed coupled with the slow surface speed of the work results in such a mild cutting action that no heat sufficient to produce surface ductility will result.

If the ultimate in Superfinishing technique is desired, machine equipment is available in which the work r.p.m. can be varied, thus changing the surface speed; the abrasive revolutions of a cup-type wheel on flat work can be varied; the reciprocatory speeds of any of all of the reciprocations can be changed.

These variables of speeds can be accomplished by several different methods. One method is by driving the units through a variable speed electric motor controlled by suitable apparatus.

Other satisfactory methods drive the work and abrasives through hydraulic motors of very small horsepower so that an infinite variety of speeds is at all times obtainable.

On Superfinishing machines of the centerless type, the drive to the work is by friction rolls. This allows a certain amount of slippage automatically bringing into play the variable speed on the work which results in the random path of the abrasive grit.

The harder the material the more nearly should the abrasive attack at right angles the annular marks from preparatory operations. In this manner each individual abrasive grain has only to cut through a relatively small amount of material.

For softer materials and for nonferrous materials the ratio may be such that the abrasive grains do not cut as nearly at right angles to the previously produced annular scratches because the softer material allows a longer cutting path of the abrasive grain without breakdown.

As the surface becomes more refined, the more nearly annular the abrasive action can become. This allows advantage to be taken of Superfinishing technique by varying only the work speed.

The total pressures applied to Superfinishing stones for various production operations will range from 338 lb. for brake drums down to 6 lb. for tappets.

Unit pressures are, as a general rule, greater for hard materials than for soft materials. Surface roughness also affects the pressure necessary; the coarser the surface the greater the pressure required. In some installations variable pressure is desirable. This is because at the start of the process the broad stones cut first on the high peaks or ridges or surface defects. This point contact, it might be termed, will result in sufficient abrasive pressure to perform a cutting operation even though the application of total pressure to the stone is slight.

As the peaks of the defects are removed the bearing area of the work becomes much greater so that the unit pressure will become so small that no cutting action results. It is at this stage that additional pressure should be applied to the stone in order that the unit pressure may be kept sufficient to allow efficient cutting action.

STONE LOADS FOR SPECIFIC PARTS

Part	Load in lb.	lb. per sq.in.
Tappet	6.2	30.6
Brake Drum (coarse)	284	31.5
Brake Drum (fine)	256	28.4
Flywheel	64.4	23.2
Crankshaft	48	19.9
Pistons	25	20.1

PARTS AND MATERIALS NOW SUPERFINISHED

Parts now being successfully Superfinished include:

Crankshafts.....Main and pin bearings	Brake drums.....Braking area
Pistons.....Skirt diameters	Brake linings.....Braking surface
Camshafts.....Cam contours and bearings	Cylinder blocks.....Main bearing bores, camshaft bores, piston bores, heads
Tappets..Heads, whether flat, conical or radiused and the barrels or stems	Gears.....Thrust faces
Valves.....Stems	Pinions.....Bearing surfaces
Flywheels.....Clutch faces	

Many machine parts such as ways, spindles, faces, etc.

Steel-mill rolls	Broaches	Plow shares
Paper-mill rolls	Button burnishers	Bearing rolls
Twist drills	Punches	Bearing races
Reamers	Gages	

MATERIALS SUPERFINISHED at the present time include practically all of the ferrous and non-ferrous metals as well as materials such as molded brake linings. These materials include the following:

Cast Iron.....Spun or cast	Copper.....Plated or solid
Steel.....Any analysis or hardness	Chromium.....Plated plugs, etc.
Aluminum.....Cast or rolled	Glass, wood, tin, and fiber

Molded brake lining and, in experimental installations, many more materials perhaps not as widely used as those listed.

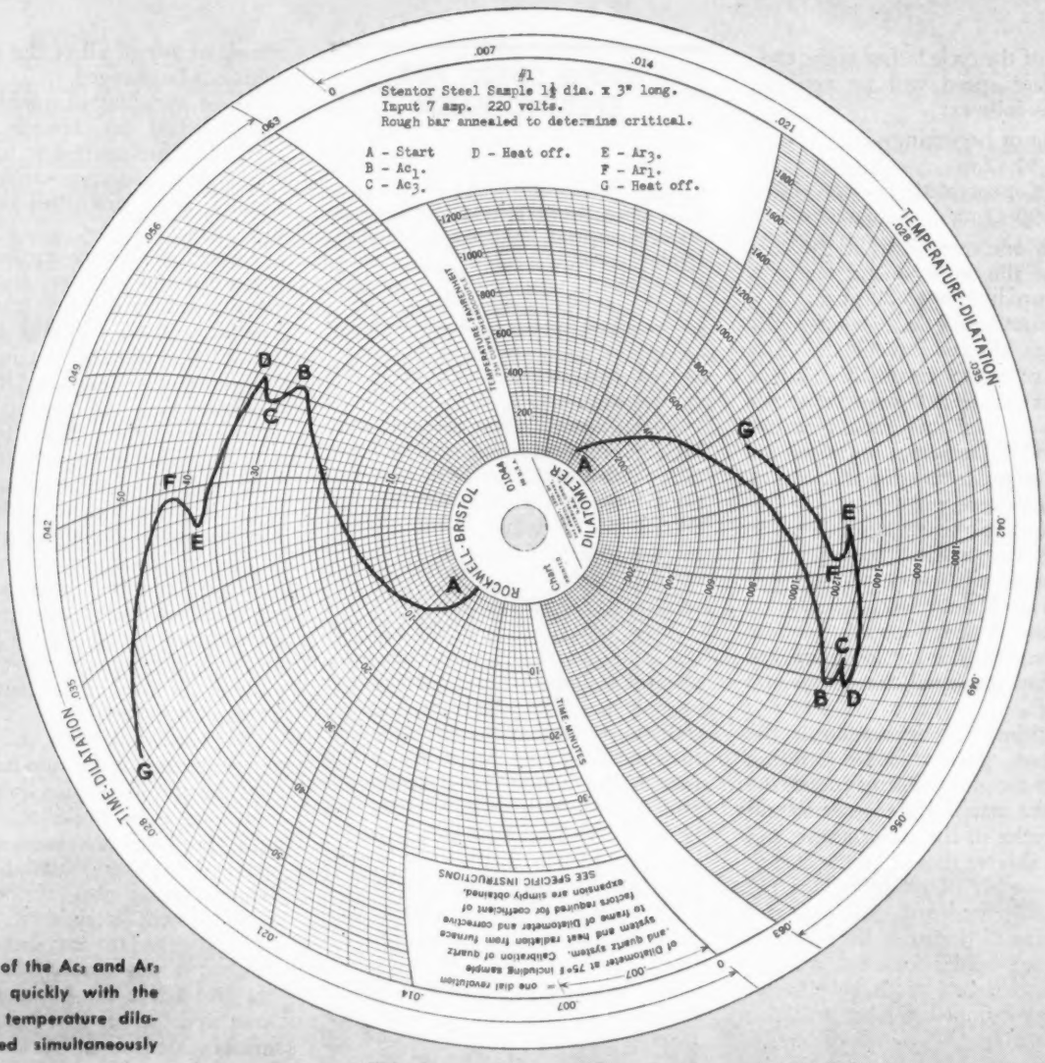


Chart 1—Determination of the Ac_3 and Ar_3 points is accomplished quickly with the dilatometer. Time and temperature dilation curves are secured simultaneously

What Heat for Treating?

The proper hardening temperature for a given steel often differs from the average value ordinarily used. Dilatometer readings help secure best results

By STANLEY P. ROCKWELL
President, Stanley P. Rockwell Company

IT IS COMMON PRACTICE for users of steel to rack their stock by mill analysis. Sometimes mill analyses are missing and S.A.E. numbers are given. S.A.E. numbers alone will vary 0.10 points in carbon content and 0.30 points in manganese content. An S.A.E. handbook will give the variations in other elements. Now add to this the plus or minus one point chemical allowable error, and you will discover that with high and low carbon and manganese contents you readily can have two different steels of entirely different hardening qualities.

To overcome this unavoidable condition steel handbooks recommend hardening temperatures much above the true hardening points in order to take care of a low carbon, manganese and alloy combination. But these hardening temperatures then are too high for the high carbon, manganese and alloys. The effect, then, is purely a compromise. Some steels, when mill heats are held, are heat-treated correctly, but more often incorrectly to obtain the best results in the finished product.

We are not decrying the need of

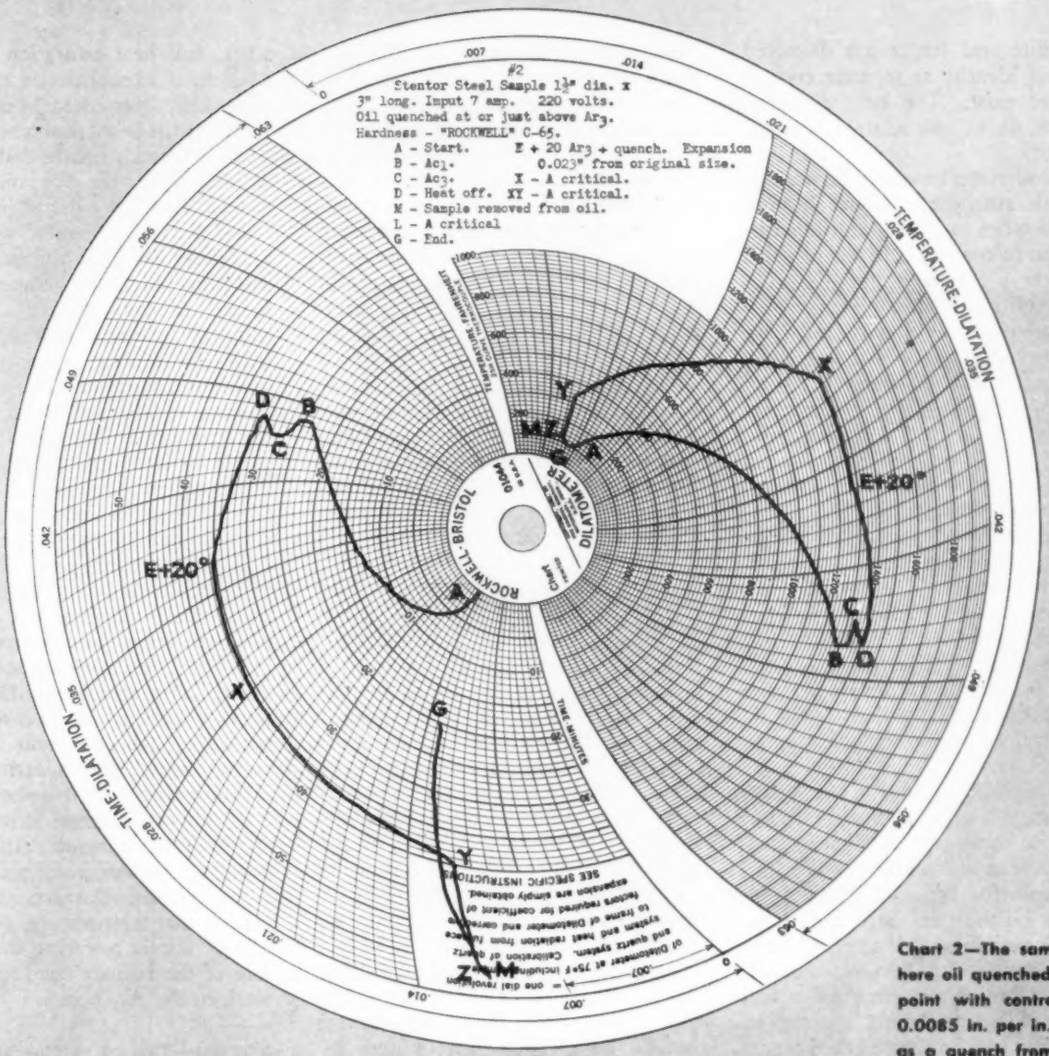


Chart 2—The sample tested in Chart 1 is here oil quenched at 20 F. above the Ar_3 point with contraction of 0.026 in., or 0.0085 in. per in., which is not as drastic as a quench from the Ac_3 point

chemical analysis. This is often done at the steel mill, and such analysis defines the S.A.E. grade or the brand name of some special tool steel. Repetition of analysis quite often is conducted in many plants, mainly because some error has been made by the mill in the past and the customer forever after distrusts mill analyses and so spends a lot of unnecessary money in analytical work. If he does not analyze and the steel company makes another mistake or he himself mixes up the stock, he is then in a position where a lot of parts have been spoiled. To get himself out of trouble he must resort to the chemist or metallurgist, and then finds himself like the man who has locked the door after the horse has been stolen.

A chemical analysis may cost from four to ten dollars, and take two or more hours to complete. Even then it will not tell the correct hardening heats. With the Rockwell-Bristol dilatometer 30 min. will tell exactly the mose important temperatures for heat-treatment with no more sample preparation than for chemical analysis.

A bar of steel may cost from four to 30 cents per pound. This does not represent real money, but when this bar is made up into parts such as collets, punches, and dies costing from $20 to $500 to fabricate it is time for all to be concerned in its heat-treatment. The dilatometer is the only precision instrument that will give this information. A sample cut by any means from the bar in question, from one to four inches long and from ¾ to 2½ in. in diameter or square, corner to corner, with a ¼-in. hole drilled in one end for thermocouple insertion and with ends roughly parallel suffices for a dilatometer test. The run on such a sample is shown on Chart 1. The Ac_1, Ac_3 and Ar_3 points are the important temperatures to note and to stamp on the bar, and to be transferred to the bar or tool if such numbers are removed in machining.

Now all steels in a machinable condition are made up of two different crystal grain structures, and all we need consider is the carbon and iron in the steel. All the other chemical elements are absorbed in these two crystals, or surround them as a matrix or binder. These two crystals are known as ferrite, meaning pure iron, and pearlite, meaning an iron containing 0.90 per cent carbon, and may be considered in the light of a drop of water and a crystal of sugar. As the temperature in a piece of steel is increased, or a crystal of sugar is allowed to stand in a teaspoon of water, there will come a time when these pearlite crystals and ferrite crystals, or the sugar and water, will start to dissolve into each other. The Ac_1 point is the point at which this dissolving starts to take place. This dissolving is a question of temperature in the case of the steel and time in the case of the water and sugar. The dissolving action continues until all the crystals

of pearlite and ferrite are dissolved and their identity as separate crystals ceases to exist. The new dissolved structure, in the case of steel, is called austenite.

To harden steel we must secure this austenitic structure. Higher heating does no more to the austenitic structure than to coarsen it, if quenched it will show a coarser grain.

On cooling steel in air a reverse action takes place. From Ac_3 to Ar_3 we have austenite capable of being hardened. After the Ar_3 point is passed it is too late to quench, as the austenite starts to change to ferrite and pearlite to Ar_1. After Ar_1, on air cooling slowly, the steel again is composed of pearlite and ferrite.

If heavy machining is to be done and a low anneal is desired to relieve machining strains, a temperature not exceeding the Ac_1 point, whatever its temperature may be but close to it, say 20 F. under, will be better for the steel in preventing later warpage than the usually recommended 1,250 F., which is not always most suitable for the steel.

Should it be desired to improve machining, a spheroidizing anneal should be conducted at a mean temperature average between the Ac_1 and Ac_3 points for a period of time dependent on the steel, information on which is available in all accepted heat-treaters' handbooks. Temperatures just in excess of the Ac_3 point give full anneal. Close to the Ac_3 point, but not below, will be secured the best results for fineness of grain size. Any anneal temperature above the Ac_3 point merely coarsens the grain structure without decreasing hardness.

The Ar_3 point is of great importance. Chart 1 shows the total expansion of a 3-in. specimen from 100 F. to the Ac_3 point (see Note 1) plus a slight temperature increase to be sure that the Ac_3 point had been fully reached (see Note 2), this temperature being 1,380 F. The expansion in inches for this sample, plus dilatometric expansion, is 0.035 in. (see Note 3). In other words, the expansion for a 1-in. length of this sample from the usually conducted hardening temperature of Ac_3 plus is 0.0112 in., which means on quenching it must return to its room temperature size in a matter of seconds.

Now the sample studied, and also a component tool, after passing the Ac_3 point is in a hardenable condition as long as it does not fall in temperature below the Ac_3 point. Any temperature higher than the Ac_3 point merely increases the grain size and volume, which is permanently set by that temperature through volume changes. Temperatures in excess of the Ac_3 point are often used in silver blanking dies to secure a greater depth of hardness on shallow hardening steels.

By use of the dilatometer the finding of the Ac_3 temperature for this work will allow the hardener to exceed the Ac_3 temperature by the same number of degrees for each die, irrespective of what Ac_3 temperature is shown from the bar of steel in question. Whatever condition of grain size by fracture or efficiency in depth of hardening is desired, the hardenable qualities exist to the Ar_3 point. Below the Ar_3 point the hardness drops off to the Ar_1 point, and cooling rates from the Ar_1 point to cold are unimportant from the standpoint of hardness or grain size.

Referring again to Chart 1, the Ar_3 point is 1,240 F. Removing from the furnace to the quenching bath at that point must be instantaneous, which is impossible. If, however, a leeway of 20 to 40 F. above the Ar_3 point is selected for the quench using, of course, common sense with regard to cross-section, the amount of contraction of the 3-in. sample to return to its original size in a few seconds at 100 F. is 0.026 in., or for the bar which this sample represents is 0.0085 in. per in., a distinct gain over quenching from the Ac_3 point of 0.0027 in. per in. Chart 2 is such a quenching curve, showing quenching from Ac_3 and 20 F. above the Ar_3 point after these temperature points have been determined by Chart 1.

It will be noticed that no reference has been made to the time-dilatation curve, which was drawn simultaneously with the temperature-dilation curve. In these curves steels of the same diameter were used, namely 1½-in. and were put to test in a cold furnace. Each sample used was run alike as to furnace input, 1½ kw., and the total time in each case to reach *D* on the time-dilatation curve, at which actual full heat saturation shown by its lack of expansion or contraction, varies only from 31 to 34 minutes.

In normal heat-treatment where the work is of such nature that work can be hardened at the Ac_3 point, the furnace is always at a hardening heat. It is realized that in such a case a higher heat head exists in the furnace, and that a steel of such a nature if not preheated (always good practice) will come to full heat saturation in less than the average of 32½ minutes, which is shown on Charts 1 and 2, starting with a cold furnace. To find this, the dilatometer furnace is maintained by its rheostat at the Ac_3 plus degree of temperature, as secured in Chart 1. Samples of ½-, 1- and 1½-in. diameters of the type of steel in question, or any convenient different diameters, should be run in the dilatometer, which will then plot a curve of diameter versus time for other diameters for that type of steel. Alloy steels, being more dense than carbon steels, will be found to take a greater time for heat saturation than plain carbon steels. For an intricate tool or die, of course, the time should be figured on the greatest diameter, and also for intricate work deemed safe to quench at the Ar_3 point plus 20 or 40 F. a second furnace should be held at that temperature, or else time will be lost in lowering the temperature of the furnace used to bring the work to the Ar_3 point.

NOTE 1—This is not the same reason for so many degrees or chart spaces as in an instrument operating on time-temperature methods, which is to allow the piece to catch up in temperature with the thermocouple.

NOTE 2—Usually the steel company will give a higher recommended heat, for safety as previously explained, but this is not necessary with the dilatometer.

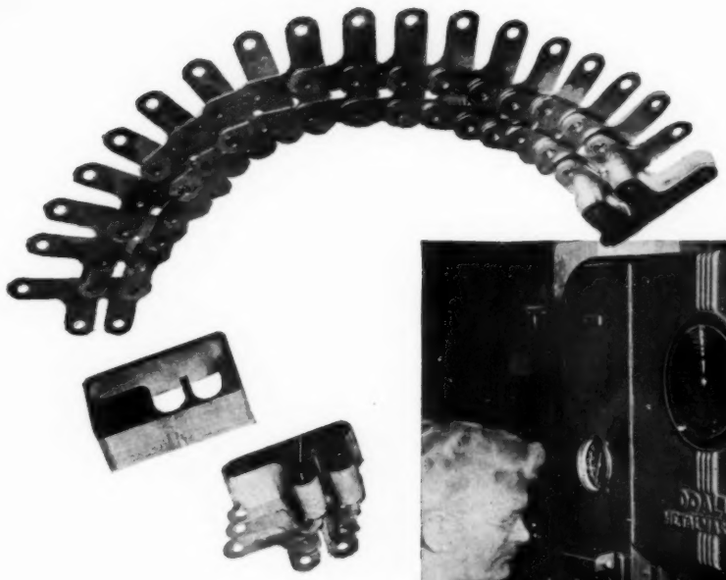
NOTE 3—The dilatometer expansion, which includes quartz and frame members heated by furnace radiation, may be disregarded for practical purposes such as this critical determination. They are of no importance except for coefficient of expansion determinations, when a simple calibration is made for these errors.

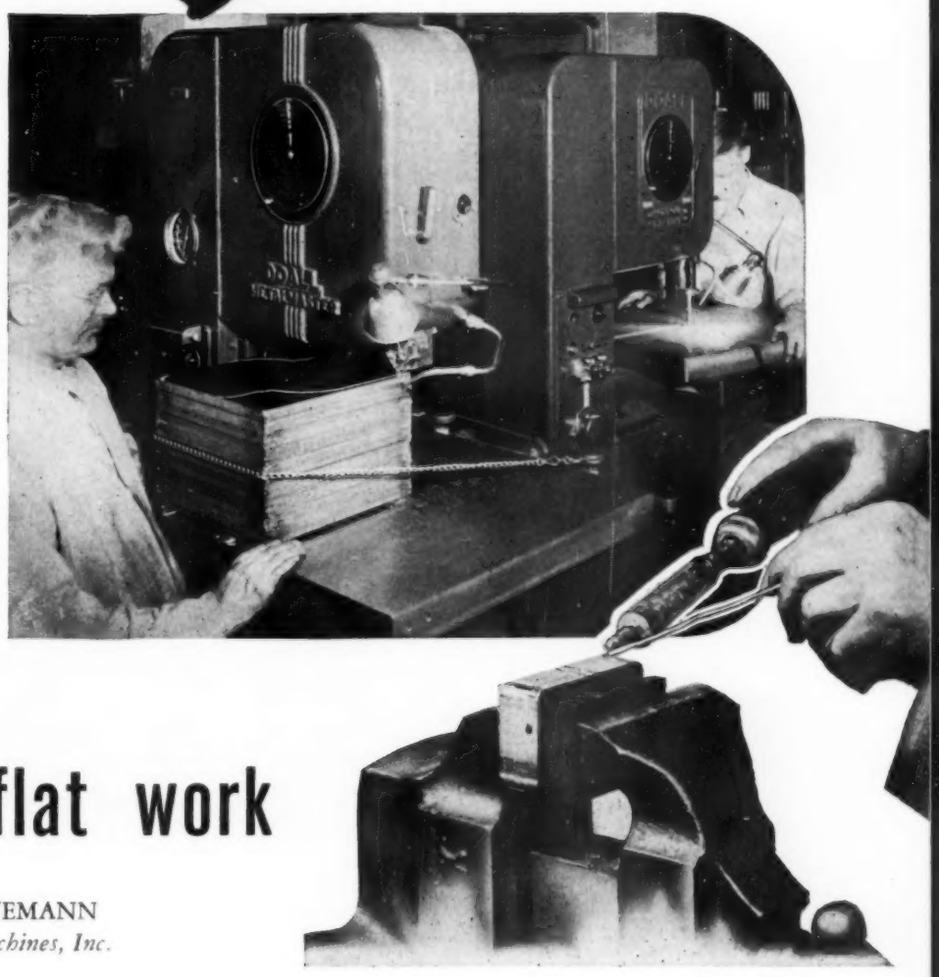
Old Ideas on New Products

Old ideas frequently lie dormant a long time before they are utilized in a new field. A case in point is the new split-race ball bearing, for use on crankpins or other places where the bearing must be made in halves. The method of splitting the ball races originated, so far as I can find out, in the old Almond drill chuck.

Tom Almond, one of the most versatile mechanics I ever knew, made the nut that operated the chuck jaws, in the same way. The ring was V-notched on both sides at opposite points. It was hardened and then broken in two at the V's, so it could be put in the groove in the chuck body and held by forcing the shell over the outside.

The broken surfaces match perfectly and make a better and cheaper fit than can be had in any other way. When held together by a suitable housing the surface is continuous, either as a ball race or as a threaded nut.





Fifty of these electric switch parts of 0.035-in. cold-rolled steel were sawed out simultaneously from scrap metal pressed in a vise and soldered together. In making flat blanks by the contour-sawing method, the number of pieces cut out at one time is limited only by the capacity of the saw. The shapes can be sawed to the exact dimensions of the layout line

No dies for flat work

By GEORGE A. HEINEMANN
Engineer, Continental Machines, Inc.

CONTOUR MACHINING has solved many industrial problems. It has eliminated the tedious operation of drilling a row of holes to make a cut-out. Dies can be sawed out and filed quickly, while special and replacement parts can be turned out in a fraction of the time required for machining them.

The newest contour-sawing process is a technique of making sheet-metal parts formerly stamped with dies. Instead of sawing out a punch and die, and setting up a press for operation, the parts are sawed out directly, and the metal sheets first being stacked and welded or soldered together.

The welding or soldering is best performed while the sheets are compressed tightly in an arbor press or, in the case of smaller parts, in a bench vise. Pressing the pieces together rather than merely relying on their weight to keep them in close contact has three effects: The bonding is simplified and made more certain; any warping of the pieces is removed; and the easy machining quality of a solid piece of metal, uninterrupted by air pockets, is gained.

Simple geometric shapes can be laid out on the top piece by conventional practice with instruments or by a templet. Intricate shapes may be cut out with the same ease as simple ones, since the chief factor controlling the sawing time is the length, not the contour of the layout line. For simple circular pieces only a radius need be indicated, a circle cutting attachment being available on the contour saw.

The question arises: When is this method more economical than press work? A cost analysis of a special part job done in this way reveals several costs that are common to both methods and some costs which are high in one place and low or non-existant in the other. Die cost is an important portion of all stamping work, and when the cost of a die is spread over a small number of pieces, the die cost per piece is exorbitant. With the contour-sawing method, the labor cost per piece is relatively high; on high-speed press work it is almost negligible.

Naturally, the contour-sawing method has its limitations. It is for flat work, and cannot be expected to replace forming or piercing press work. It is, however, a material contribution to a manufacturer's ability to make blanks and special parts in quantities from 50 to 500 with economy, accuracy and speed.

Drilled Tappets Cost Less

Buick finds it cheaper to drill out 60 per cent of the metal in a machined slug than to bore a cored casting

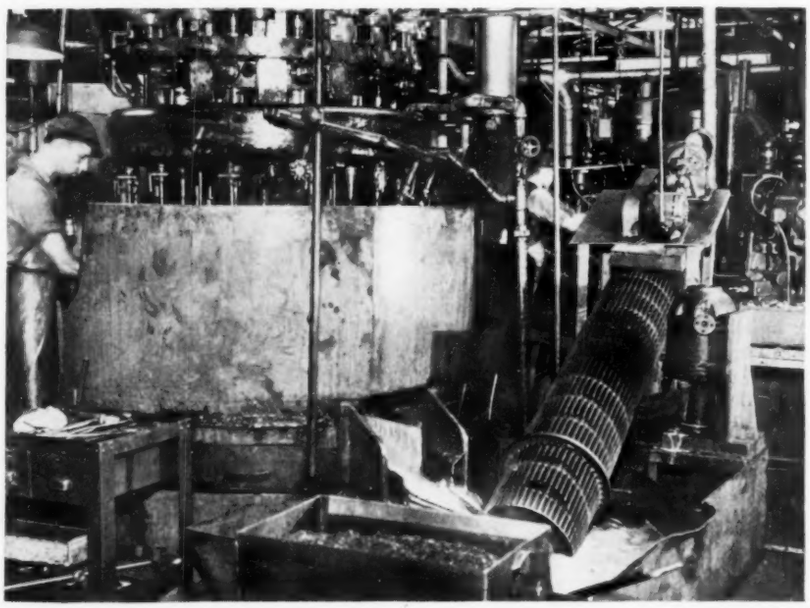
BUICK'S SET-UP for producing valve tappets is based upon careful analysis of the best features of contemporary practice. These methods have been modified and adapted to the shop's problems, in order to achieve certain aims: (1) The lowest over-all cost per piece, consistent with quality standards and the output handled; (2) reduction of operator fatigue to a minimum and concentration of his attention upon feeding the machine by supplying adequate parts-handling devices between operations; and (3) a compact, yet uncrowded layout. That these aims have been secured will be evident from a study of the production methods in use.

Valve tappets for Buick engines are made from solid cast-iron slugs, instead of castings cored out to suit the push rod. The master mechanic's department maintains that it is cheaper to drill from the solid, using the latest continuous equipment, than to bore out cored holes.

First step in machining the tappet is to pass it through centerless grinders to obtain an accurate cylindrical locating surface for later operations. A Cincinnati centerless machine equipped with six wheels 4 in. wide breaks through the scale and roughs the piece, allowing stock for finish at final operations. Another centerless grinder, which is fed by a chute from the preceding machine, semi-finishes the tappet to a 0.002 in. limit on the outside diameter. A chute delivers ground parts to tote pans on a roller conveyor. At this point a comparator provides a periodic check of the size.

Both ends of the tappet are next ground on a double-end Gardner drum-type machine. If the work should be too long after the grinding operation, a gage-and-limit switch cause infeed motors on both opposed wheel spindles to feed in the correct amount.

Drilling out the slug is done on a Davis & Thompson Roto Matic twelve-spindle machine that has fixtures with automatic clamping and ejection means. This operation is done contrary to usual practice. The feed is heavy and the drill speed is low, which is the reverse of usual practice on cast iron. The feed is maintained at 0.016 in. and the speed at 60 surface ft. per min., as compared to 100 or more in the usual recommendation. The Buick method was evolved from studies undertaken with a single-spindle unit, in which the speed and feed were varied until the best combination for this particular job was obtained. The work and drills do not heat up as much as in conventional practice and more production per grind is obtained.



Valve tappets are ejected automatically from the fixtures of the Davis & Thompson drilling machine. They fall down a chute into a screw conveyor that lifts them to a Morris angle-head grinder. Chips drop into a sump

Since the closed end of the tappet is chilled, the chamfer on that end is produced with a Morris angle-head grinder. Pieces falling out the rear of the preceding drilling machine are separated from chips and transported via a screw conveyor to tote pans on a short roller conveyor adjacent to the grinder. Parts are taken from the tote pans and placed in a trough that feeds them to automatic grinder chucks.

Three drilling operations and a chamfering operation are carried out next on a station-type Greenlee. Each fixture has six loading positions. The tappets are slipped closed-end first into the fixture holes, and a set of six flush-pin plungers is advanced to push the parts home. Each plunger enters the previously drilled hole in a tappet. If the hole is too shallow in any piece, the corresponding flush pin protrudes beyond the gaging surface. In that case, the piece is removed from the fixture. The reason for this set-up is that the tools on the Greenlee advance at high traverse feed until almost touching the work. A piece with a shallow hole would cause the tool to hit the work while traveling at high speed. Tool breakage must be minimized on a high-production machine of this type, hence the gaging precaution.

The Greenlee performs these op-

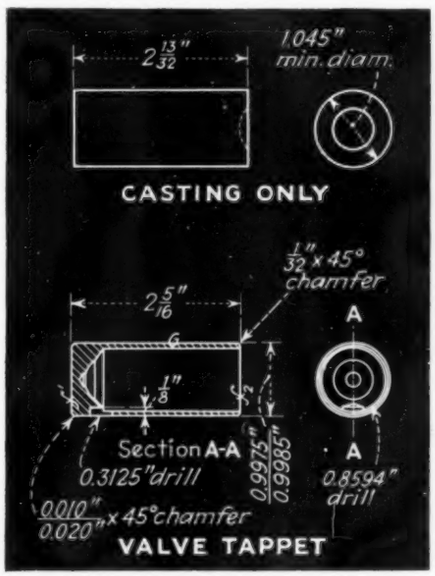
A variable-speed drive on the conveyor chain in the final parts washer can be set for the most efficient loading of the hooks. A finger knocks washed parts off the hooks and into a chute. Nicks or cracks in the parts are avoided by providing the tote-pan table with power elevation, so that pieces do not fall too far

Finish grinding the closed end of the valve tappet is done on a two-wheel Blanchard. Calipers automatically feed down the wheels as they wear. Tappets are ejected automatically and fall down a chute into a screw conveyor that takes them to a washing machine. A hot soda water wash and clear rinse prepares the parts for a special chemical treatment of the surface. Washed tappets are discharged by the washer into tote pans. Hardness of the chilled ends is next checked with a Scleroscope.

At this point the tappet has been machined sufficiently to permit a combination normalizing and Ferroxing process, which is carried out in Homo-Carb furnaces. The chemical treatment provides the piece with a black oxide coating that has the faculty of holding oil and wearing-in to an exceptionally hard smooth surface. This surface is allowed to remain only on the chilled face.

The heat-treating process acts to relieve any strains in the tappet, with the result that the cylindrical surface may have waves. To overcome this condition, the part is passed through

Flush-pin gaging plungers are drawn back while the operator inserts the valve tappets into a fixture at the loading position of a four-station Greenlee. Again a screw conveyor takes away the automatically ejected pieces

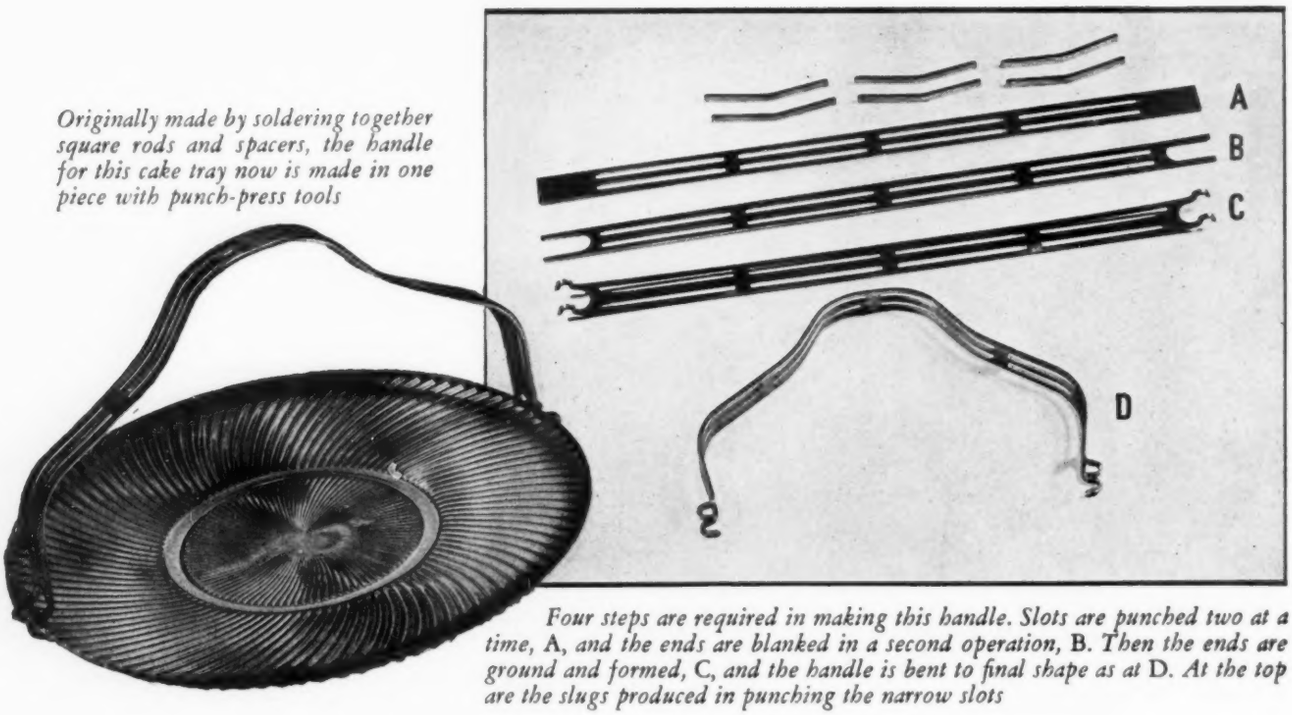


Most of the metal in the solid slug is removed by drilling, but this method is cheaper than boring out a cored hole

erations: (1) drill a small oil-relief hole below the spherical seat, (2) drill the spherical seat, (3) drill a crosshole, and (4) chamfer the open end. Cemented-carbide tools are used for the first two operations. Pieces are ejected automatically into a screw conveyor that drops them into tote pans on a roller conveyor.

five Cincinnati centerless grinders that remove a total of ten thousandths. Four machines take off four, three, two and one thousandths, respectively, while the last machine imparts a mirror polish; the latter is not a lapping process. The final step in the process is to pass the finished work through a washer.

Originally made by soldering together square rods and spacers, the handle for this cake tray now is made in one piece with punch-press tools



Four steps are required in making this handle. Slots are punched two at a time, A, *and the ends are blanked in a second operation,* B. *Then the ends are ground and formed,* C, *and the handle is bent to final shape as at* D. *At the top are the slugs produced in punching the narrow slots*

Narrow Slots With a Punch

Narrow slots which leave thin walls tax the ingenuity of the tool designer. Here is how one such problem was solved

By MARK GOLDEN

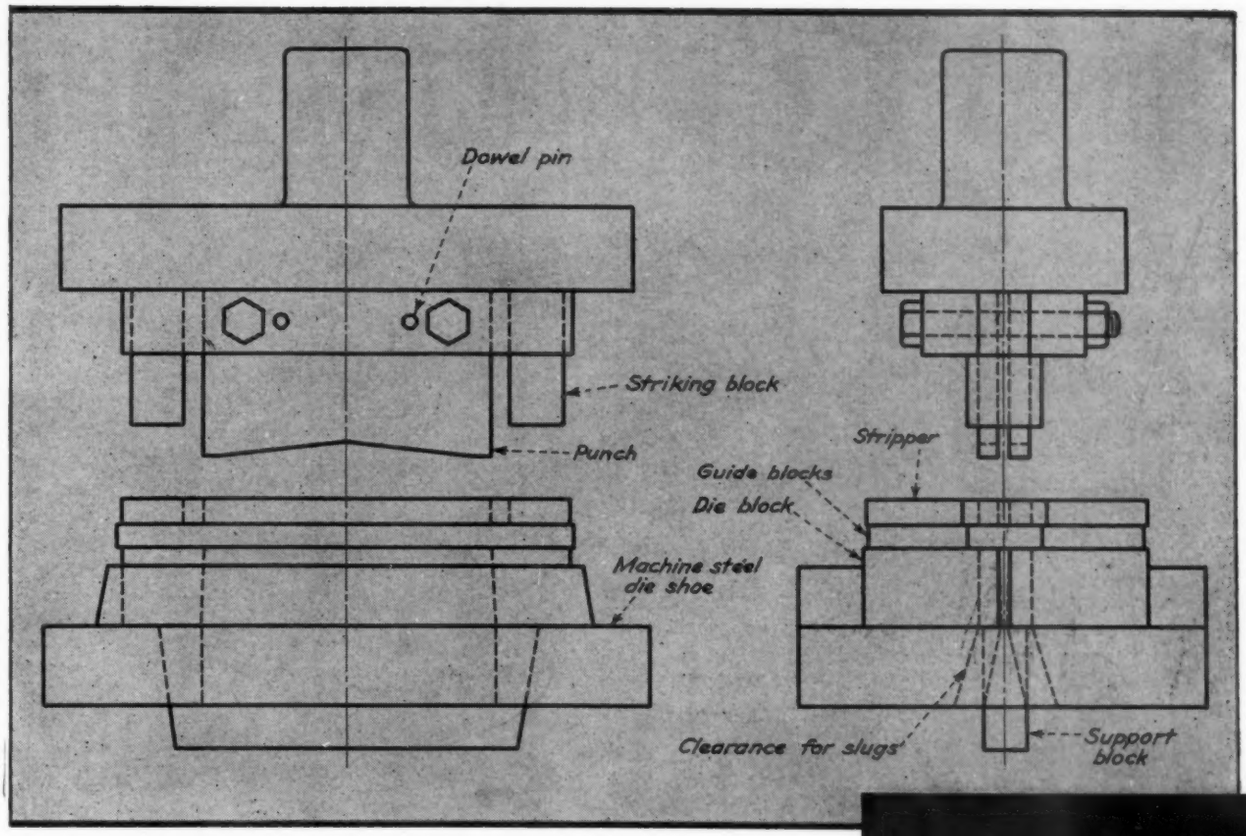
PUNCHING narrow slots in thin cold-rolled steel without distortion is difficult, particularly when the slots are located so as to leave only a thin wall of metal on either side. The handle for the cake tray shown presented just such a problem. Originally made of $\frac{1}{8}$-in. square brass rods separated by small brass rectangles soldered in position, this handle is now produced by punching and bending a strip of $\frac{1}{8}$-in. thick cold-rolled steel. This latter method has reduced costs sufficiently to meet competition, and has resulted in a stronger unit.

Most difficult operation in making the handle is punching, two at a time, the $\frac{1}{4}$x$3\frac{5}{8}$-in. slots, leaving a $\frac{1}{8}$-in. wall between the slots and along each side of the piece. Because of the thinness of the wall between the two punches, it was necessary to provide additional support under the die section so it would stand the strain of continually punching $\frac{1}{8}$-in. stock. This support is given by a block of oil-hardening steel fitted under the center wall. After being hardened, the block was forced into the machine-steel shoe under 100 tons pressure with a hydraulic press. This much pressure was used to insure no further recession of the block while the die is in use.

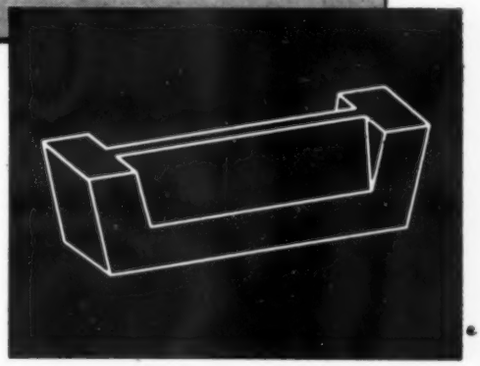
The punches start cutting at the ends of the slots and shear toward the center. In addition, striking blocks mounted at each end of the punches hit the stock at the bottom of the stroke. These, together with the center shear on the punches, help keep the stock flat.

Die and punches were made from Ackerlind "Green Label" oil-hardening tool steel hardened in a Leeds & Northrup electric furnace. The steel was brought up to 1,400 F., allowed to cool, then heated to 1,475 F. and quenched in Texaco No. 2 quenching oil. Tests showed a hardness of 65 Rockwell C. The parts were then drawn to 450 F., resulting in a final hardness of 60 Rockwell C. These tools have been used for about 100,000 handles (about 400,000 punchings per punch) in six months time without mishap. They have required grinding only twice during that time.

To complete the handle, several other operations are necessary. The next punches the ends, which are then ground at an angle. A foot-press operation forms the ends. Final shape is produced by bending in a simple die set up in a power press, and by finish forming in a hand-operated fixture. It is then polished and plated.

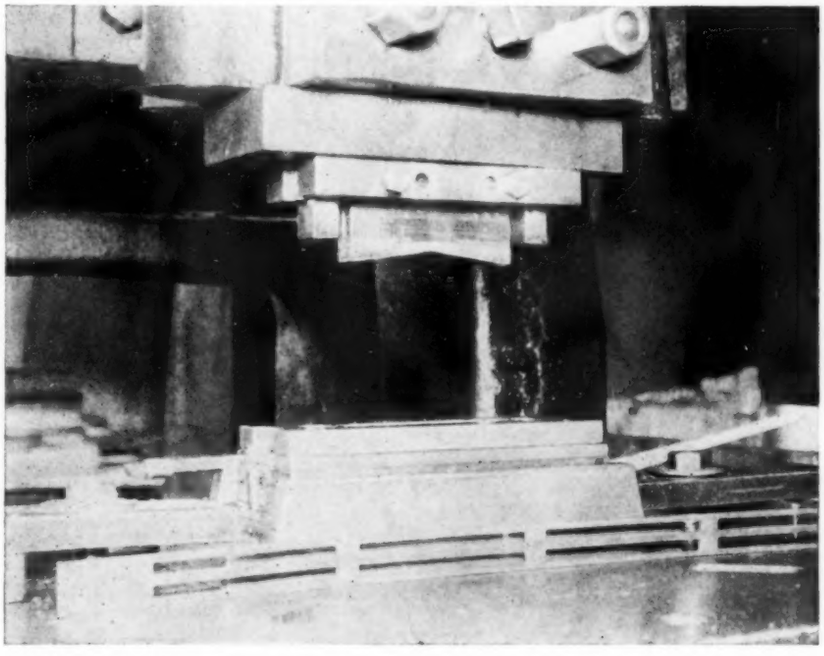


The die for punching the narrow slots has a narrow center wall supported by the formed block shown at the right



This block is hardened and then forced into the die shoe to support the thin center wall of the die

These tools produced about 100,000 handles with only two regrinds. Punches shear toward the center to help keep the work flat



Who's Got the Master?

By ED WEST

Many shops are doing astonishingly accurate work with various kinds of "go" and "not-go" gages. Many others claim to be getting a high degree of accuracy, but when we find that the master gages are locked up in the toolroom away from everybody or gathering dust we believe that today's accuracy may be tomorrow's rejects. This is true because the accuracy of inspection depends a great deal on the inspector having the proper touch or "feel." The master should always be kept with the gage so that the inspector can check his sense of touch frequently. This will also serve as a check against other possible errors due to temperature changes or accidents to the gage.

IDEAS FROM PRACTICAL MEN

Automatic Stacking Fixture

By W. M. HALLIDAY
Peterborough, Northants, England

In the illustration is shown a rapid-operating fixture for automatically transferring to and stacking blanked parts into the magazine of a punch press to bring them into the feed chute of an adjoining machine which performes another operation.

Essentially, the fixture consists of the baseplate *A* attached to the bolster; the cylindrical slide *B;* the actuating pin *C* attached to the slide; the coil spring *D;* the plug *F;* the steel balls *H;* the finger *I;* the plunger *K;* the guideway *L;* the wedge-shaped block *M;* the magazine *N;* and the necessary brackets and screws.

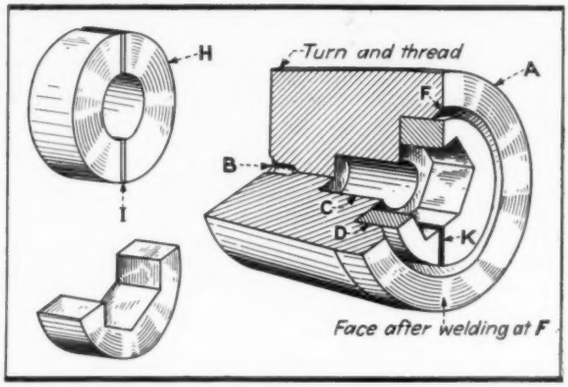
In operation, on the first descent of the ram a piece is blanked and falls through the die (not shown) onto the extended bottom plate of the guideway *L*. On the ascent of the ram, a plate attached to it contacts the under side of the pivoted finger *I* at one end, causing the opposite end to depress plunger *K* and force the balls in the vertical row downward. Since the centers of the balls in the vertical row are behind the centers of those in the horizontal row, the balls in the horizontal row are pushed to the left, carrying with them the cylindrical slide *B* against pressure of spring *D*, causing pin *C* to push the blank into the guideway and make room for the next piece blanked.

When the ram descends, pressure on the balls is released and spring *D* forces the slide to the right against plug *F*, thus bringing all parts back to the starting position. As the ram continues its descent and approaches the bottom of its stroke, the second piece is blanked. When the slide is again pushed to the left, pin *C* pushes both blanks along and the first blank is pushed over the wedge-shaped block *H* and far enough into the magazine for it to tilt so that the leading edge of the advancing blank will go under its uptilted edge and force it upward. Thus as each succeeding blank is pushed into the magazine it goes under the blanks already in it and is added to the stack.

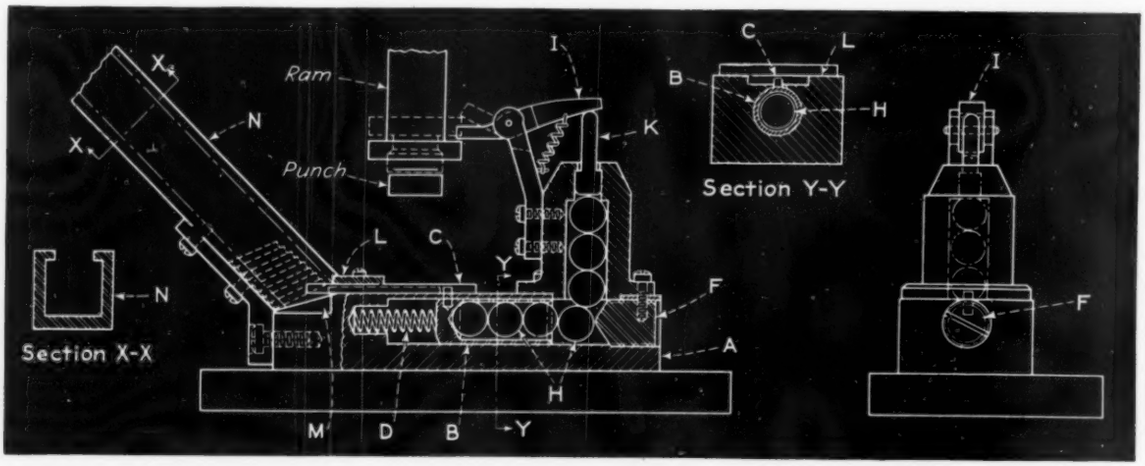
A Fast Way to Make Pipe Plugs

By H. J. CHAMBERLAND

We had an order for six 4-in. pipe plugs to be tightened with a hexagon wrench and to be delivered that same day. Referring to the illustration, the plugs, one of which is shown at *A*, were made of



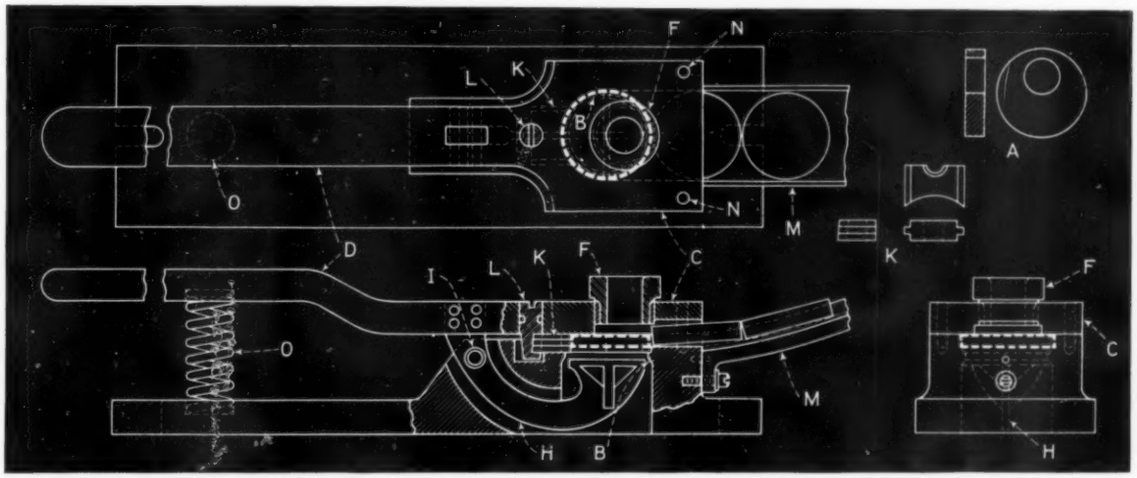
Round parts cut in two and having half-hexagon holes machined in them were assembled in counterbores in the pipe plugs and securely held by welding



When a blank enters the magazine it is tilted over a wedge-shaped block so that the blank behind it will go under its edge and push it upward

cold-drawn steel and each was centered at *B*, bored at *C* for a plug mandrel, counterbored at *D* and internally beveled at *F*. It was then turned, faced and threaded.

Part *H* was bored, faced and cut in two at *I* by a 1/16-in. saw. The parts thus cut off were held in the shaper vise in gangs of six and half-hexagon holes were machined in them, account being taken of one-half the width of the slot. Two of these parts were assembled in counterbore *D* of each plug and were held 1/16 in. apart by wedges at *K*. It remained only to weld them in place, depositing the welding metal in the internal bevel *F*, leaving a hexagon hole for the wrench.



Preparatory to drilling eccentric A, the blank is held down by a spring-actuated bushing plate and is forced against one side of its seat by a pusher actuated by a taper pin

Quick-Acting Drill Jig for Small Eccentrics

By GEORGE C. LAWRENCE

The jig illustrated was designed for drilling small eccentrics, one of which is shown at *A*. Essentially the jig consists of a base having a seat *B* for the work; the bushing plate *C* which is extended to form the lever *D* and carries the bushing *F* and the knockout *H*, the latter being pivoted at *I*; the pusher *K* having a half hole on one side in which the taper pin *L* engages and being cut out on the opposite side to fit the work. It also has tongues on the ends that slide in channels in the jig body; the loading slide *M*; the steady pins *N*; and the spring *O* for operating the clamping mechanism.

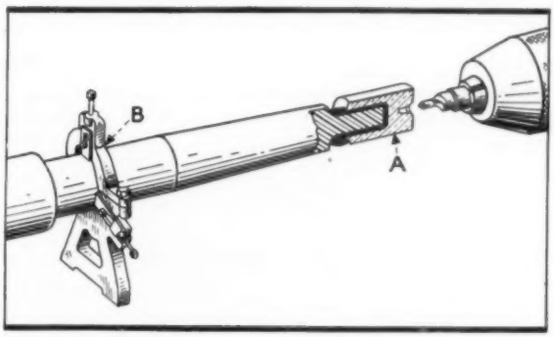
In operation, when the lever is slightly depressed, the bushing plate rises and a blank is pushed down the loading slide and onto its seat by the fingers. Releasing pressure on the lever causes the spring to bring the bushing plate down on the blank and at the same time the taper pin forces the pusher to push it against one side of its seat. To unload the drilled eccentric, the lever is depressed, causing the bushing plate to loosen its grip on the work and the knockout to raise it from its seat so that it can be pushed out at the side. Another blank is then pushed down the loading slide and onto its seat and is clamped by the action of the spring when pressure on the lever is released.

Salvaging Taper-Shank Tools with Broken Tangs

By E. N. OLSON
Toolmaker, Philadelphia Navy Yard

Quite often drills, end mills and machine reamers have been discarded because of broken tangs. However, the life of such tools can be prolonged by forming new tangs and regrinding the taper shanks so they will enter the taper holes in machine spindles far enough for the newly formed tangs to engage the driving slots. But the breaking of tangs has left them without center holes and new ones must be provided before the taper shanks can be reground. After the remaining parts of the broken tangs have been ground off square, new tangs are formed, usually by grinding.

If the tool being salvaged is made of high-speed



A piece of round brass slotted to fit the new tang freely is sweated in place and is center drilled and countersunk for regrinding the taper shank

steel, the tang is likely to have hard spots that may dull or break the centering tools. In such a case a piece of round brass *A* is slotted to fit freely on the new tang, and both tang and slot are well tinned and sweated together. To center drill and countersink the brass piece, the cutting end of the tool is held in a spring collet in the lathe spindle and the body is mounted in a steadyrest at *B*. Drilling and countersinking are done by tools held in a drill chuck in the tailstock spindle. With the brass piece center drilled and countersunk, the cutting end of the tool is held in a spring collet in the work spindle of the cylindrical grinder and the tang end is supported by the tailstock center for regrinding the taper shank. After the shank has been reground, the brass piece can be removed by heating it sufficiently to melt the solder.

If the tool is made of carbon steel, the tang is likely soft enough to be drilled and countersunk, and there will be no need for the brass piece.

One Way of Grinding Slender Work on Centers

By THOMAS WILKINSON

Recently I was given the job of grinding six test rods 36 in. long to a diameter of 0.6875 in., the limits being plus 0.0002 in. minus 0.0000 in. and plus or minus 0.0003 in. for straightness and concentricity. The job would have been no problem in a precision centerless grinder, but since the only machine available was a universal cylindrical grinder, it was necessary to proceed carefully. Since the actual length of each rod was 36 in., and the dog required 1½ in. only 34½ in. were left to be ground.

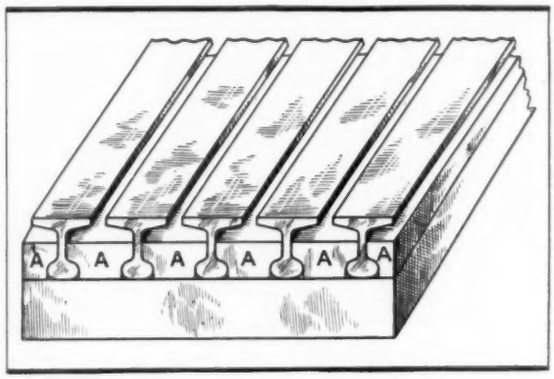
The first step was to grind the four evenly spaced spots *A, B, C* and *D* for back rests, removing just enough stock to obtain concentric surfaces. After grinding spot *A* and testing it with a dial indicator, a back rest was adjusted to it. The same procedure was repeated for spots *B, C* and *D,* in that order. It was then possible to grind spots *F, H* and *I* in the order given. However, they were finished to 0.6878 in. or 0.0003 in. over the required diameter.

After giving the grinding wheel a fresh dressing, the actual bearing *F* was finished first and the back rest was taken from spot *C* after testing it with the indicator. The back rest on spot *D* was no longer needed and it was therefore removed. Actual bearing *H* was then finished in the same way, indicated and the back rest taken from spot *A*. The actual back resting was completed by finishing spot *I,* to which was adjusted the back rest taken from spot *B*. Thereafter it was just another cylindrical grinding job. The standard travers feed and the work speed applicable to the diameter of the work were used, but the infeed was held to within 0.0005 in. for each longitudinal movement of the table.

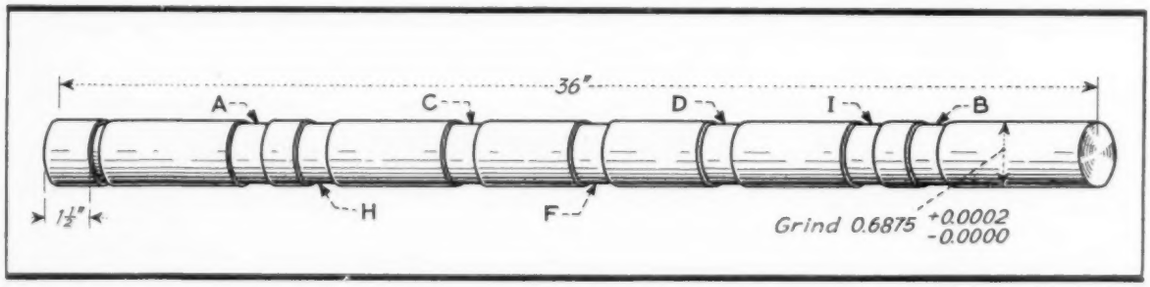
T-Slots that Don't Break

In shops where rough, heavy work has to be bolted to machine tables it is not uncommon to see pieces broken out of the sides of the T-slots. A husky operator with a long wrench puts more strain on the cast metal than it was designed to stand.

One shop of this kind has remedied the difficulty by supplementing the machine tables, drilling machines in this case, with a new table surface made from railroad rails as shown. These rails are cut to length, and fastened to the table in an inverted position. The flat, or underside of the rails form the work surface.



The rails are held by blocks such as *A,* cast to the right shape to space the rails and to clamp them firmly in place. Space between the rails form T-slots that will stand any amount of abuse. With the working surface finished by grinding, which is the easiest way, such a table has many advantages in shops that have trouble from the cast T-slots breaking out from undue tightening of bolts.



To grind such slender work in a centerless grinder would have been no trick, but to grind it on centers to such close limits required care and skill. The diameter of the rod is shown three times larger for clarity

Metal-Cutting Power Calculations

By PAUL H. MILLER, *Engineer, Carboloy Company, Inc.*

HEREIN IS presented a simple formula for obtaining the approximate power requirements for machining a variety of metals. It was developed from experimental data, collected over a period of years, which were studied (1) to see if any consistent relation existed between the physical properties of the metal and the power required, and (2) to discover the relation of chip thicknesses and widths to the power required. The investigation covered the machining of a variety of S.A.E. steels, several grades of plain and alloy cast irons, and a few non-ferrous metals and alloys.

The formula was developed to eliminate the trial-and-error method of determining whether or not a machine has sufficient power to handle a proposed machining job, that is, by actually tooling up the machine and setting it in operation at a preselected speed and feed. Such procedure frequently results in loading the machine beyond its capacity with consequent stalling and destruction of the cutting tools, and perhaps damage to the machine itself.

The formula is as follows:

$$\text{Input horsepower} = A + B$$

where

B = horsepower at each tool
$= D \times F \times S \times C$

and

A = friction horsepower (lost in machine)
$=$ 25 to 30 per cent of B for new machines
$=$ 35 to 40 per cent of B for old machines

The constants

D = depth of cut, in.
F = feed, in.
S = cutting speed, ft. per min.
C = power constants listed in tables I and II.

Because very little power-consumption data are available for steels harder than 400 Brinell, it is suggested that a power constant twice the average-job power constant in Table I be used where steels of such hardness are machined.

When developing this formula, the steel machining data studied revealed that the power required to machine any one grade of steel was approximately proportional to the Brinell hardness of the steel. Further investigation disclosed that steels having similar physical and chemical characteristics required approximately equal power for machining. On the basis of this behavior it was considered practicable to divide the various steel grades into groups and assign to each group an empirical power constant for each of several ranges of Brinell hardness. A similar relation between power required and Brinell hardness was found to exist for several grades of plain and alloy cast iron and a number of non-ferrous metals and alloys.

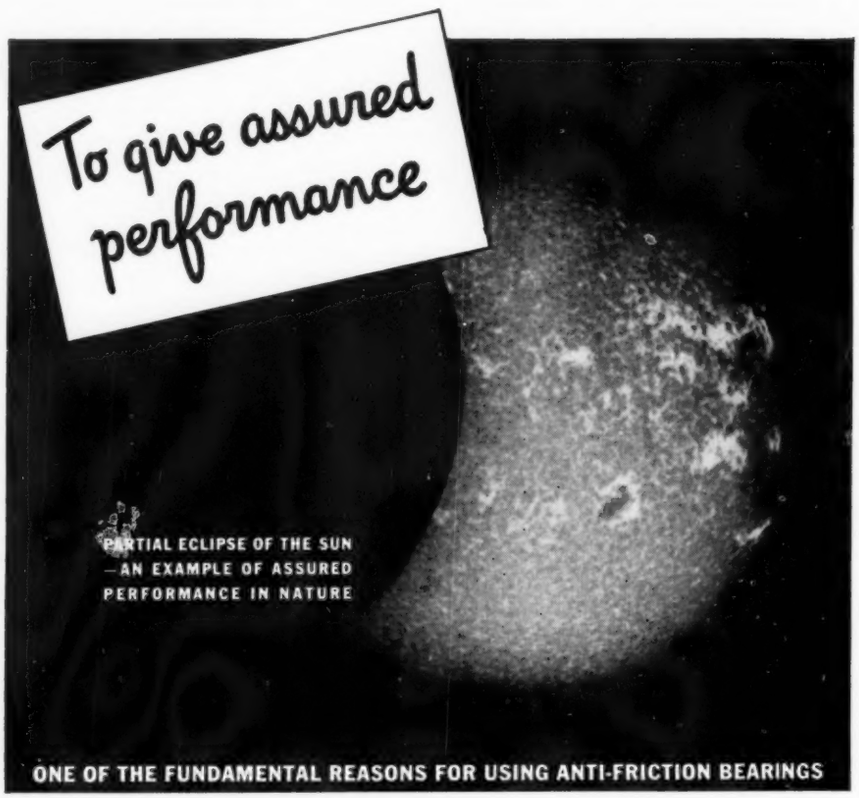
The power constants for ferrous metals and alloys are listed in Table I and for non-ferrous metals and alloys

TABLE I—POWER CONSTANTS FOR FERROUS METALS AND ALLOYS

Material	Power constant for average jobs	C — Power constants — Brinell hardness numbers 100 to 125	126 to 150	151 to 175	176 to 200	201 to 250	251 to 300	301 to 350	351 to 400
S.A.E.									
1010– 1025	6.0	5.5	6.0	7.0	8.0	....	....	....	....
1030– 1055	8.0	....	6.0	7.0	8.0	9.5	11.5	....	....
1060– 1095	9.0	....	....	....	....	9.0	10.5	12.5	....
1112– 1120	6.0	4.0	5.0	6.0	....	....	....	....	....
X1314–X1340	5.0	....	4.5	5.0	5.5	6.0	....	....	....
T1330 T1350	9.0	....	....	....	8.0	9.0	11.0	13.0	....
2015– 2115	7.0	6.0	7.0	8.0	....	....	....	....	....
2315– 2335	7.5	....	....	6.5	7.0	7.5	9.0	11.0	....
2340– 2350	9.0	....	....	....	6.0	7.0	8.5	10.0	12.0
2512– 2515	8.0	....	....	6.0	7.0	8.0	9.5	11.0	....
3115– 3130	8.0	....	5.0	6.0	7.0	8.5	10.0	12.0	....
3140– 3450	9.0	....	....	....	6.0	7.5	9.0	10.5	12.5
4130– 4345	9.0	....	....	....	5.5	7.0	8.5	10.0	12.0
4615– 4820	9.0	....	....	5.5	6.0	7.0	8.5	10.0	11.5
5120– 5150	10.0	....	....	5.5	6.0	7.5	9.0	10.5	12.0
52100	10.0	....	....	....	7.0	8.0	10.0	12.0	....
6115– 6140	9.0	....	....	5.5	6.5	8.0	10.0	12.0	....
6145– 6195	12.0	....	....	....	8.5	10.0	12.0	14.0	16.0
Plain cast iron	4.0	....	3.0	3.5	4.0	5.0	6.0	....	....
Alloy cast iron	4.0	....	....	3.5	5.0	6.5	....	....	....
Malleable iron	4.0	3.0	4.0	5.0	....	....	....	....	....
Cast steel	9.0	....	....	7.5	8.0	9.5	....	....	....

NOTE: For steels over 400 Brinell, double the value of C in the column "Power constant for average jobs."

WHY ANTI-FRICTION BEARINGS?


To give assured performance
PARTIAL ECLIPSE OF THE SUN —AN EXAMPLE OF ASSURED PERFORMANCE IN NATURE
ONE OF THE FUNDAMENTAL REASONS FOR USING ANTI-FRICTION BEARINGS

● Because of the dependence placed upon them in the production line, machines of modern design can afford to employ only those parts whose reliability and service life can be accurately determined *before* they are used. That is why more and more machine builders are standardizing on ball bearings — the fundamental bearing type which gives assured performance.

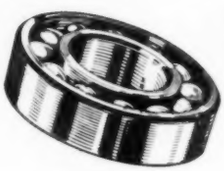
The ball bearing has a thoroughly sound background of scientific principle governing its design, and the life and capacity of ball bearings — New Departure *ball* bearings — are subject to as accurate mathematical determination as is the strength of a steel bridge. New Departure ball bearings are the last word in anti-friction bearings.

For free brochure, IT-3, "Bearings — the Life of the Machine," write New Departure, Division of General Motors, Bristol, Conn.

Field Performance
as Determined in Advance
by Bearing Engineers

Millions and millions of New Departures of all types and sizes must be right, when uniformly they demonstrate the same result — that their performance in the field is precisely as determined by the bearing engineers, before they made even one revolution in a wheel or on a shaft.

NEW DEPARTURE

THE FORGED  STEEL BEARING

2841

Metal-Cutting Power Calculations

TABLE II — POWER CONSTANTS FOR NON-FERROUS METALS AND ALLOYS

Material	*C* — Power Constant
Brass:	
Hard	10
Medium	6
Soft	4
Lead screw stock	3
Bronze:	
Hard	10
Medium	6
Soft	4
Aluminum:	
Cast	3
Hard (rolled)	4
Monel (rolled)	12
Zinc alloy (die cast)	3

in Table II. In order to simplify the use of the Table I, there is listed in the second column a power constant for average jobs. The basis for the selection of this value lies in the fact that each grade of steel and cast iron encountered in the average shop usually has a limited range of Brinell hardness. For this reason it is usually safe to use this "average job" constant whenever the Brinell hardness is not obtainable, or when only a rough approximation of the required horsepower is desired. When the Brinell hardness of the steel or iron is known and it is desired to obtain a more accurate power calculation, the constants listed for the various ranges of Brinell hardness should be used.

The study of the relation between chip proportions and power disclosed that the power was close to being in direct proportion to chip width and also to chip thickness for all chips greater than 0.015 in. thickness. For chip thicknesses less than 0.015 in. the ratio of power to thickness was somewhat greater, but it was only with very thin chips (less than 0.007 in.) that the deviation from direct proportion was appreciable. Since it is very seldom that power consumption is a governing factor with chip thicknesses much less than 0.015 in., it was decided that the formula should not be made more complicated in order to take care of the special case of thin chips.

A convenient form for calculating the total horsepower at the tools and the input horsepower to the machine is given in Table III.

Test Checks of the Formula

The following cases illustrate the agreement between values of horsepower calculated by the formula herein given and values obtained from actual tests made by the General Electric Company:

Case 1—The machining of S.A.E. 2335 steel.

Brinell hardness 205
Number of tools 1
Depth of cut, in. ..... $\frac{5}{16}$
Feed, in. 0.025
Surface cutting speed, ft. per min. 302
Power constant (from Table I) 7.5
Horsepower at tool *B* calculated:
$B = D \times F \times S \times C$
$= \frac{5}{16} \times 0.025 \times 302 \times 7.5 = 17.7$
Horsepower *A* lost in machine, assumed as 30 per cent of *B*:
$A = 0.30B = 0.30 \times 17.7 = 5.31$
Horsepower input (calculated):
$A + B = 17.7 + 5.31 = 23.01$
Horsepower input by test = 22.0

Case 2—The machining of S.A.E. 1020 steel.

Brinell hardness 122
Number of tools 1
Depth of cut, in ..... $\frac{1}{2}$
Feed, in. 0.045
Surface cutting speed, ft. per min. 250
Power constant (from Table I) 5.5
Horsepower at tool *B* calculated:
$B = D \times F \times S \times C$
$= \frac{1}{2} \times 0.045 \times 250 \times 5.5 = 31.0$
Horsepower *A* lost in machine, assumed as 30 per cent of *B*:
$A = 0.30B = 0.30 \times 31.0 = 9.3$
Horsepower input (calculated):
$A + B = 31.0 + 9.3 \ldots = 40.3$
Horsepower input found by test ..... = 38.4

TABLE III—SUGGESTED FORM FOR CALCULATING MACHINE HORSEPOWER

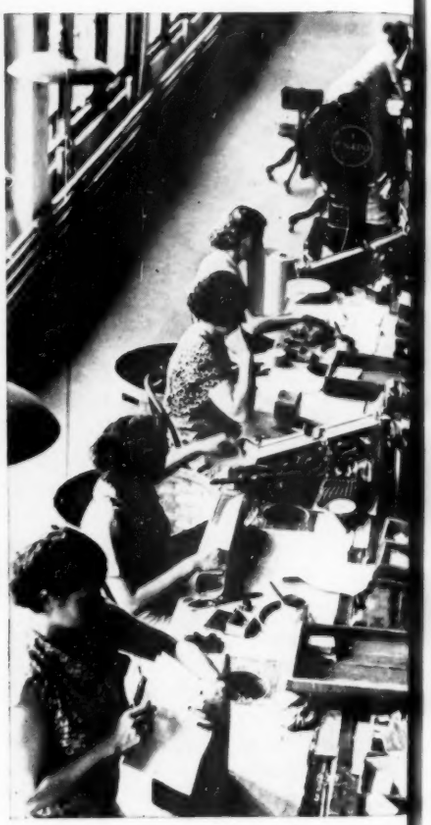
Horsepower *B* absorbed in actual machining, tools cutting simultaneously:
B for tool No. 1 = $(D \times F \times S \times C)$* ..... = ...
B for tool No. 2 = $(D \times F \times S \times C)$* ..... = ...
Etc ..... = ...
Total horsepower required by tools in the cut, *B* ..... = ...
Horsepower lost in machine, $A = P^{**} \times B$ ..... = ...
Total horsepower input required, $A + B$ ..... = ...

* Insert actual values for *D*, *F*, *S* and *C*.

** *P* = per cent of *B* lost in the machine = 25 to 30 per cent for new machines and 35 to 40 per cent for old machines.

As tools come from the factory they are wrapped in protective oiled paper, boxed and labeled for protection against dirt and moisture, and to facilitate prompt shipment.

Left: Central shipping floor, fireproof tool storage bins and racks on either side.



TO GIVE YOU G. T. D. TOOLS

Quickly . . Safely

These pictures suggest the facilities maintained by G.T.D. Greenfield to insure adequate stocks, careful packing and prompt shipping, so that tool users all over the world can get any standard G.T.D. Greenfield tools in minimum time. In addition branch warehouses and distributors' stocks are carried in every industrial city in the world.

Lack of a single tap can hold up a vital assembly job, literally cost some manufacturer hundreds of dollars, perhaps as much as he would spend for taps in a year. *That must not happen to Greenfield customers.* Hence these facilities — maintained for *your use*.

PARCEL POST IS BIG BUSINESS

From this bench parcel post shipments go daily to nearly every city and state. This service, rendered for distributors, speeds up delivery of the many semi-special sizes and types of tools which constitute a large part of the business. Plenty of light and air make for fast, accurate work.

Greenfield Tap & Die Corporation · Greenfield, Mass.

Detroit Plant: 2102 West Fort St. Warehouses in New York, Chicago, Los Angeles and San Francisco
In Canada: Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ont.

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

The Bug Got Us

ABOUT this time of year editors feel the urge to pontificate on the state of the nation. Few editors resist the urge. We turned thumbs down on the idea until a week ago, but the bug finally got us.

As we see it, our foremost job in 1940 is to stay out of war. Many forces, some from within our own ranks, are trying to get us involved. But fortunately Mr. Average American remembers the world war and knows that there is no profit in war for anyone. Industry knows it too.

Our involvement would quickly end individual liberties, just as it has in democratic England and France. Our best course would seem to stay a great and strong democracy ready to assume leadership in the task of world reconstruction when the present war ends.

While we are keeping out of war we must not lose sight of our own economic problems. Eight to ten million people are still unemployed. How can industry put them back to work? How can the purchasing power of Bill Smith, who is employed down the street in a radio factory, be raised? How can the farmer's income be increased, for if he doesn't prosper, industry's market for its goods is greatly restricted? Is there nothing ahead except to divide up what we already have or is the United States yet to progress to further heights?

If we as a nation can approach the solution of any of these pressing problems in the next twelve months, we shall have accomplished much.

Then what of labor relations? Admittedly they aren't what they should be. Blame it on whatever you will—the Wagner Act, labor unions, management, or a combination of all three—the fact remains that good feeling between employers and employees is not as widespread as it should be. Not the least requisite is a tolerant attitude on each side toward the other. We Americans comment caustically on the inability of Europe to keep the peace. Yet we seem unable to keep labor peace in our own country.

Now a word about our actions as individuals. This country has the kind of government that most of the people want. All of us follow what is going on in Washington, but many of us are negligent in following the day-to-day activities of our local governments. And, after all, the foundation of our democracy is the local political unit, not the national. It is sad but true that Joe Bloke, who votes a straight ticket each year according to suggestions handed down from party headquarters, exerts more influence than those of us who get steamed up only every fourth year. Let's remember that democracy is not a static condition but is ever-changing.

Just one more thought. Another presidential election is only ten months away. We shall be battered from all sides with whispering campaigns, emotional outbursts, charges and countercharges, promises. Let's try to get FACTS. If a candidate says he believes in "the private enterprise system without government control," suppose we pin him down to a definition of "private enterprise" and "government control" and find out what he will do about both.

In short, let's keep our minds clear and our feet on the ground.

Burnham Finney

GAGING BUSINESS

Record backlogs point to continued full-capacity operations for many branches of the metal-working industry. Feverish war buying impulse begins to fade.

Operations in many branches of the metal-working industry will be at or near full capacity during the first quarter of 1940. This is in favorable contrast with a much lower production rate a year ago. Backlogs are at record levels. In some lines, such as steel, however, incoming business recently has not kept pace with output. Machine tool builders and aircraft companies, on the other hand, are not making much progress in cutting down their huge volume of unfilled orders. One trend definitely discernible is a fading out of the feverish buying impulse which prevailed the first 60 days after war was declared.

MACHINE TOOLS—Sales in December are reported to have been less than those during November, though the volume last month was high. Many dealers say that both orders and inquiries have declined. Though foreign purchases continue substantial, most machine tool builders are leaving room for domestic orders so that they can take care of regular customers in this country on a reasonable delivery basis. Some companies have gone so far as to restrict foreign allotment of their output to 25–40 per cent of the total. The industry's volume of business from companies making peacetime products is edging upwards. Builders' plants will be running close to full capacity the next six months.

FARM EQUIPMENT—The upturn which began in the Fall, better grain prices and good reports from dealers about prospective Spring sales indicate that 1940 will be much better than 1939. A poor first half the past year brought sales down 10 per cent below 1938. Success of the Allis-Chalmers small $345 combine built at Laporte, Ind., will bring International Harvester into the market shortly with a competitive low-priced machine. Minneapolis-Moline recently announced a new 69-inch combine.

RAILROAD EQUIPMENT—Total orders booked during 1939 were about 53,000 freight cars and 300 locomotives. Production of 500 lightweight welded freight cars is under way at Pullman-Standard's Michigan City, Ind., plant. At the same time 100 cars are being built for the New York Central and Pennsylvania at the Chicago workers, delivery to begin in May. The Wabash will spend $2,800,000 repairing box cars. Chile is to buy locomotives at a cost of $1,000,000. American Car & Foundry has I.C.C. permission to build four riveted aluminum alloy tank cars for handling 95 per cent nitric acid.

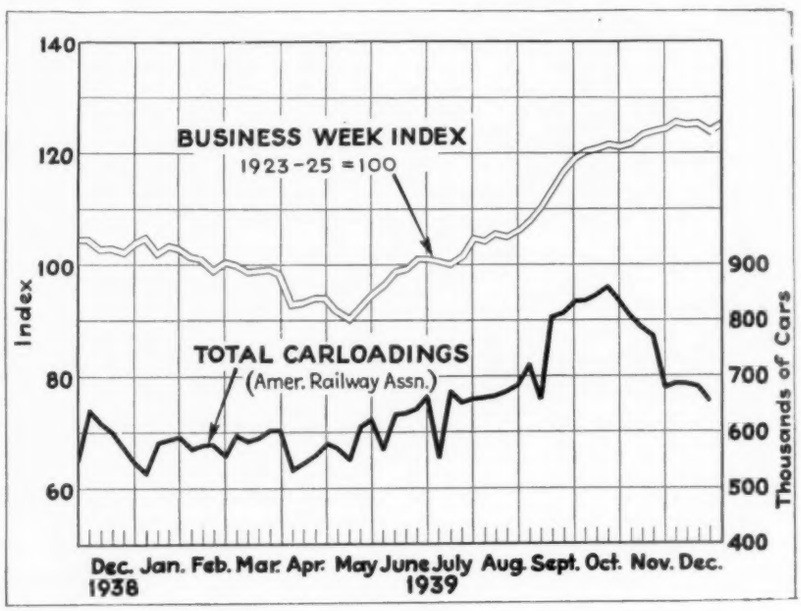
STEEL—Steel operations rebounded sharply the past week from the dip to 74 per cent during the holiday period. The usual year-end lull has cut steel sales considerably, but releases are expected to expand the latter half of this month. Much tonnage will come from the automobile industry, which has a stiff production schedule for the first half of 1940. Railroad business looks good, too.

AIRCRAFT—Foreign aircraft contracts totaling $50,000,000 are expected to be signed in the next 60 days by U. S. manufacturers. Currently the backlog of unfilled orders for planes, engines and accessories is estimated at almost $600,000,000. A year ago it was about $175,000,000. Plant expansions completed or started in 1939 will increase capacity 30 to 40 per cent. Lockheed will spend $1,750,000 for development of new models and $6,000,000 for new tools and machinery.

GOVERNMENT ORDERS—U. S. government agencies, principally the army and navy, have awarded contracts to metal-working companies for $28,366,820 the past fortnight. Included in the total are $1,114,454 for gun mounts to Baldwin Locomotive works, $716,800 for cartridge cases to Bridgeport Brass Co., $302,640 for cartridge brass cups and discs to American Brass Co., and $536,760 for searchlight units to Sperry Gyroscope Co., Inc.

CONSTRUCTION EQUIPMENT—New welded equipment, including power shovels, will be a feature of the coming road show. Link-Belt already has announced a new line of Speeder shovels. Diesel crawler-type tractors of higher power and speeds also will be prominently displayed.

SHIPBUILDING—Practically all of the ship ways in the country are engaged at present and will be fully occupied for many months. In fact, present plans for further expansion of the U. S. Navy will increase employment in navy yards and private shipyards to a new peak to be reached in 1941. Shipbuilding companies now have contracts for 108 new commercial vessels comprising a total of 833,355 gross tons, the greatest number since the world war.



LABOR BOARD POWER EXTENDED BY SUPREME COURT

Ruling, favorable to C.I.O., gives N.L.R.B. almost unlimited authority to decide employee representatives

WASHINGTON (Special Correspondence)—The Wagner Act says that "the findings of the Board as to facts, if supported by evidence, shall be conclusive." This means that there shall be no appeal from such findings to the courts. In its three decisions January 2, the Supreme Court upheld this language, saying that the federal courts could modify a Board ruling only when strictly legal questions are involved.

The Supreme Court knocked the AFL flat in the Pacific Coast longshoremen's case by upholding the NLRB certification of a coastwise CIO bargaining unit. Employers on the coast evidently want an all-inclusive unit, and a majority of longshoremen (9,557 out of 12,860) voted for CIO. But the AFL has, or had, local majorities in Tacoma and three smaller ports. CIO agreed not to press for recognition in those places.

In the Consumers Power case, the board ordered an employee election which resulted in a vote of 1,164 for CIO, 1,072 for AFL and 741 for neither. NLRB then ordered a second election placing only the CIO name on the ballot, and the Circuit Court said "Whoa." The Supreme Court stuck close to the law, told the Circuit Court that it had no power to interfere with election orders. The court said in the Falk Corp. case that the Circuit Court had no right to amend a board order directing disestablishment of an independent union.

All of this means that NLRB has almost unlimited power to determine employee representatives. It is equivalent to power of life or death over this or that union. In the longshoremen's case the board can interpret "employers" to mean an association of employers.

Oddly enough, William Leiserson of NLRB has been struggling for "local options" and plant-wise rather than industry-wise bargaining units. He says it is more workable that way, more democratic, wiser. But he has been voted down by his two colleagues, J. Warren Madden and Edwin S. Smith.

As a result of the House investigation of NLRB, a surge of sentiment has risen against Mr. Madden and Mr. Smith which is likely to lead to their replacement as board members. At the same time, Mr. Leiserson seems slated to become chairman. If the President doesn't move Mr. Madden out (perhaps by appointment to a federal judgeship), Congress is in the mood to do the job all at once by passing a law changing the board membership from three to five, thus necessitating new appointments.

Various campaigns to amend the Wagner Act are still alive and vigorous. But Congress is populated by politicians who like to please anyone who can vote when elections are in sight.

$10,000,000 FOR ARSENALS

WASHINGTON—The War Department is expected to ask for $10,000,000 for new equipment for Army arsenals to be spent during the fiscal year 1941. This is in addition to the $6,000,000 being spent this year.

ASKS HUGE DEFENSE SUM

WASHINGTON—In addition to outright military and naval cost, President Roosevelt in his budget message to Congress Jan. 4 proposed $500,000,000 semi-defense expenses, raising the total to $2,336,137,000—about one in every four dollars of total federal spending for 1941. He asks $369,000,000 for 24 new warships and continued work on 92 now building. An emergency defense program of $574,000,000 is proposed for the current and next fiscal years to remedy pressing defense inadequacies. There is no precedent for such defense expenditures, except during the World War.

NEW DEAL TURNS FROM BUSINESS TO POLITICS

Tax Program Up to Congress. Huge Defense Sums Expected to Be Authorized

WASHINGTON—The New Deal met its enemies on Capitol Hill last week to fight for its life. Both sides turned from national business to politics. President Roosevelt, in his annual message, said next to nothing, keeping his rabbit in his hat. He defended his trade treaty program (which expires in June) as well he might, for opposition is growing.

There is likely to be much talk and little action about reducing expenditures. Roosevelt laid the tax responsibility in the lap of Congress which probably will take no action until after income tax returns in March.

Important revision of the wage-hour law is not expected, though a

British Combine

On the Line—*Though disliked by the British, conveyor assembly lines have been pressed into service to help speed manufacture of military vehicles. Here small fittings are attached to the chassis prior to mounting the bodies*

Recorded—*Because variables affecting quality of spot welds are not under precise control, a device has been developed by General Electric Company to indicate and record these variations. Known as the weld recorder, it acts as a recording instrument, signalling device and lockout control. Above, one is being used by Edward G. Budd Mfg. Company in the fabrication of stainless steel frames for aircraft control surfaces. The company has 40 such units*

$200,000 IN PRIZES ANNOUNCED IN LINCOLN WELDING CONTEST

CLEVELAND—A 2½-year program of scientific study, aimed to produce wide-spread social and industrial benefits and which will culminate in payment of $200,000 in awards, has been announced by the James F. Lincoln Arc Welding Foundation.

A total of 458 awards have been established for studies bringing out benefits of a social, economic, or commercial nature derived from use of welding in industry. Embracing the 12 classifications and 46 subdivisions into which the industrial field has been divided for purposes of participation, the awards range from $13,700 to $100. Classification are: automotive, aircraft, railroad, watercraft, structural, furniture and fixtures, commercial welding, containers, welderies, functional machinery, industry machinery, and maintenance.

Participation is open to everyone who plays any part in actually bringing about progress in the executive, design, fabrication, manufacture, construction or maintenance phase of industrial product development. Either a single author or a group of authors may submit a study.

tough fight may be staged. In his budget message, the President proposed new taxes to raise $460,000,000 for defense purposes. He warned against taxing consumers, thus directing attention to possible increases in income, estate and inheritance rates.

Total defense expenses for 1941 are budgeted at $1,829,000,000 compared with $1,159,000,000 in 1940. The present battleship building program is to be increased from six to ten, and combined air forces of the Army and Navy are to be stepped up to 10,000.

The Army and Navy are expected to fight harder than previously for huge expansion funds, and are expected to get them. Many Congressmen resent Secretary of Navy Edison's request that Mr. Roosevelt be given broad power to commandeer factories, ships and resources on a peacetime emergency basis.

EDUCATIONAL ORDERS SMALL

MONTREAL—Recent British educational orders placed in Canada include one of $5,000,000 for shells from Massey Harris Co., Toronto. Dominion Bridge Co., Lachine, Que., has a similar order said to run $4,000,000 after initial production has been completed. Robert Mitchell Co., Montreal, has installed facilities for producing aircraft parts and has obtained a small educational order.

U. S. Government Contracts Awarded to Machine Tool Makers

(Other Metal-Working Contracts on Page 26j)

Contractor	Gov't Agency	Commodity	Amount
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy	Planer	$248,550
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy	Lathes	10,166
Gisholt Machine Co., Madison, Wis	Navy	Turret lathes	32,390
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	Navy, Ordnance	Milling machines, grinders	133,215
New Britain Machine Co., New Britain-Gridley Machine Div., New Britain, Conn.	Ordnance	Chucking machine	20,580
Niagara Machine & Tool Works, Buffalo, N. Y.	Navy Yard	Squaring shears	10,980
Lake Erie Engineering Corp., Buffalo, N. Y.	Navy Yard	Hydraulic press	29,900
Universal Boring Machine Co., Hudson, Mass.	Navy Yard	Boring machine	10,651
Brown & Sharpe Mfg. Co., Providence, R. I.	Navy Yard, Ordnance	Grinders, screw machines	172,700
Warner & Swasey Co., Cleveland, Ohio	Navy Yard	Turret lathes	10,328
Monarch Machine Tool Co., Sidney, Ohio	Navy Yard, Ordnance	Lathes	71,717
Bryant Chucking Grinder Co., Springfield, Vt.	Navy Yard	Grinder	17,370
Bodine Corp., Bridgeport, Conn.	Ordnance	Drilling machines	11,190
Rotor Tool Co., Cleveland, Ohio	Navy Yard	Pneumatic drills	15,986
Taft-Pierce Mfg. Co., Woonsocket, R. I.	Navy Yard	Tools, fixtures	13,494
Esco Engineering & Sales, Inc., Detroit, Mich.	Navy Yard	Tools, fixtures	15,311
Bullard Co., Bridgeport, Conn.	Navy	Turret lathe	15,503
Hydraulic Press Mfg. Co., Mount Gilead, Ohio	Navy	Presses	14,140
Clearing Machine Corp., Chicago, Ill.	Ordnance	Hydraulic press	12,143
Wm. Sellers & Co., Philadelphia, Pa.	Ordnance	Grinding machines	10,526
Seneca Falls Machinery Co., Seneca Falls, N. Y.	Ordnance	Lathe	55,000
Ajax Mfg. Co., Cleveland, Ohio	Navy	Forging machine	36,275
H. B. Underwood Corp., Philadelphia, Pa.	Navy	Milling machines	13,060
Niles-Bement-Pond Co., Pratt & Whitney Div., Hartford, Conn.	Ordnance	Lathes	41,573
Lloyd & Arms, Inc., Philadelphia, Pa.	Ordnance	Lathes	23,770
American Tool Works Co., Cincinnati, Ohio	Ordnance	Lathes	19,128
H. R. Krueger & Co., Detroit, Mich.	Ordnance	Fixtures	10,160
Billings & Spencer Co., Hartford, Conn.	Ordnance	Drop hammers	26,681
Stanley F. Rockwell Co., Hartford, Conn.	Ordnance	Furnace	16,000
Oilgear Co., Milwaukee, Wis.	Ordnance	Broaching machines	12,816
Stedfast & Roulston, Boston, Mass.	Ordnance	Lathe, mills, grinder	199,115
Austin Hastings Co., Cambridge, Mass.	Ordnance	Lathes	88,696
Henry Prentiss & Co., New York, N. Y.	Ordnance	Grinders, drills	27,836
Norton Co., Worcester, Mass.	Ordnance	Grinder	46,382
Landis Tool Co., Waynesboro, Pa.	Ordnance	Grinders	12,370
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.	Ordnance	Gaging machines	15,375

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

No extensive mechanical changes likely in 1941 cars. Major car makers believed abandoning two-year body styling cycle in favor of new lines each season. Output and sales up.

DETROIT—No extensive mechanical changes appear likely in 1941 cars. The reasons are that tooling up for a new motor is an expensive operation, that reliable transportation is assured by present designs, that the rear-engine idea is not making much headway and that prompt deliveries of machine tools are not possible.

This is not to say, however, that the automotive industry will not be an active equipment buyer. As a matter of fact, inquiries lately have increased considerably. Interest springs from a desire to replace worn or obsolete equipment because the current rate of operation makes it possible to pay off the investment quickly, and from the realization that machinery added now will enable plants to step up production quickly during the spring months. General Motors have put out inquiries at least a month earlier than usual, asking for machines for such parts as pistons, connecting rods and front-axle components.

Packard is said to be figuring on buying a number of machines soon. Its projected production of 50,000 cars in the first half will mean practically peak operations during those months, and it is understood that standby equipment is not available in many departments in case of breakdowns. Furthermore, a new body is reported under consideration again.

Another project, the marine diesel engine, has been revived and details of the tooling up program are expected this week or next.

New Styles Each Season

Stress will be placed again in 1941 on body styling, comfort and safety. The local tool and die trade will have another big year, because major car companies seemingly have abandoned the two-year cycle of body styling in favor of new lines each season. Some independent companies are due for major body changes, and one is in a position to make them because of the past year's good business. Thirty-two new tool and die shops are found in the new Detroit telephone directory, which is an indication that times are good. Established shops have added new machines, new plant additions and complete new factories.

What General Motors will do about "torpedo" body styling is not yet known. It is being used on new models—two Buicks, one Pontiac and one Olds. Bodies of this type are heavier and more expensive than those of conventional design. Buick's 50 and 70 bodies, for example, are made on a special line at Fisher plant 1 in Flint. After major body shell components are tack-welded together by the use of special fixtures, the assembly goes down a long line where a large number of spot, arc and gas welds are made. It is safe to say, however, that the lower wider lines of the torpedo styling will have an influence upon competitive makes.

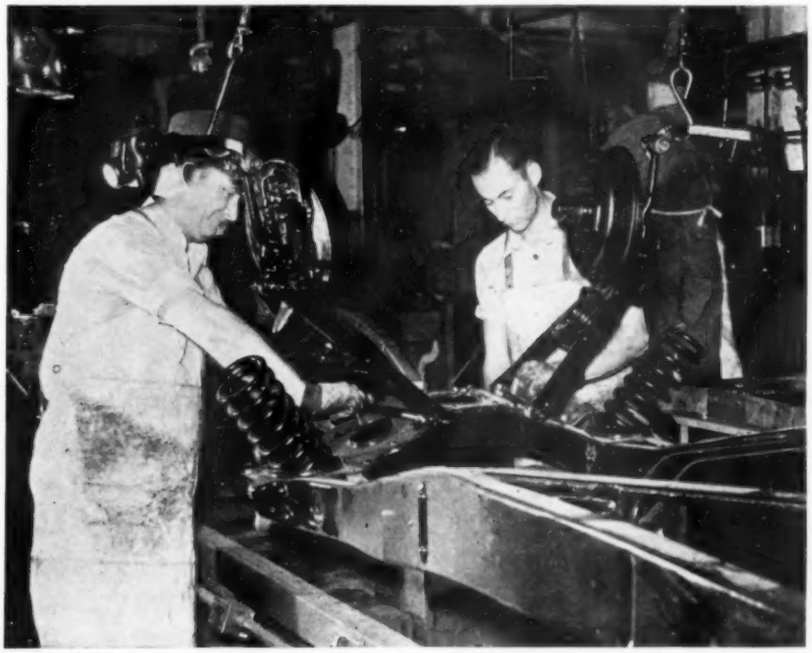
There is another angle to the matter of building wide bodies. Such cars are supplied without running boards because there is no room for them. The curve inward from the front fender to the body belt line is too slight to permit them. Hudson, offering cars with or without running boards, has found a trend toward them. If people want running boards and do not want to pay for swanky extra-wide bodies, it's a safe bet that the industry will produce both types to satisfy all comers.

Buick's success in drawing the front fender, lamp house and apron in one piece may presage the drawing of what is left of the rear fender together with the rear window panel and the metal all the way around to the rear deck opening. That development, which has been mentioned as a goal to shoot at, would make for many changes in body framing practice. The difficulties would not all be in the pressed metal department.

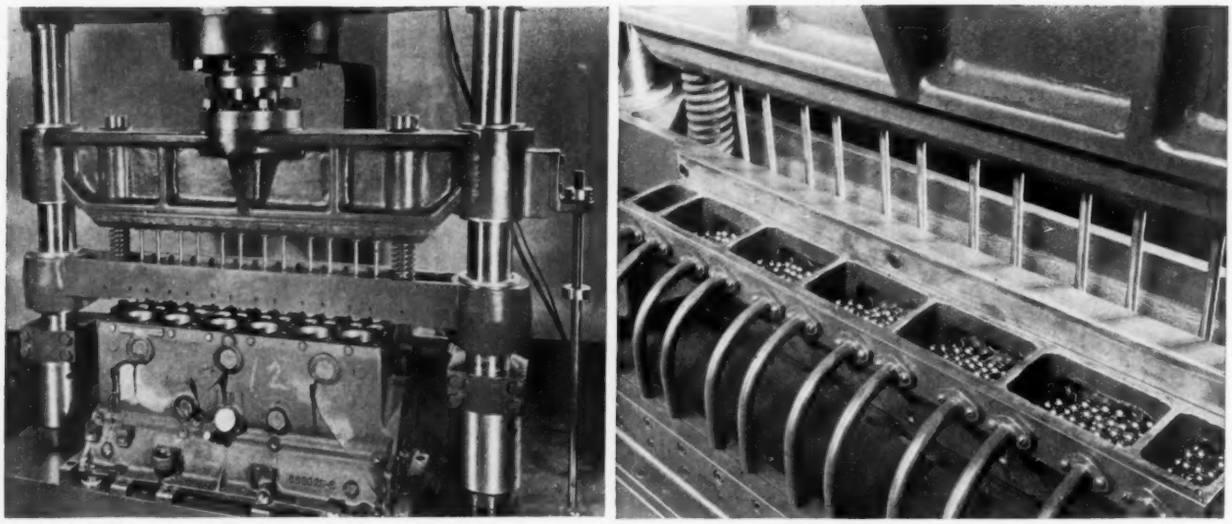
Every effort is being bent to surpass in 1940 the all-time high for motor-vehicle registrations of 30,710,000 established in 1939. Pontiac, ac-

SECOND QUARTER SALES MAY DIP

DETROIT—Fears are being expressed that automobile sales will dip during the second quarter. But earlier predictions of 1,300,000 cars and trucks for the first quarter may well be exceeded, and the industry looks for a general gain of 10 per cent in 1940, with individual gains as high as 60 per cent. Nevertheless, fingers are crossed for April, May and June. Several units with faith in their ability to operate at or in excess of present peak capacity are inquiring for machine tools for installation in the spring. This to add productive capacity for late spring and fall peaks and to retire the cost of new machines quickly.



Upside Down—*At the beginning of the Pontiac chassis assembly line, frames are carried upside down to make it easier to attach various members. Above, front wheel independent suspension subassemblies are being bolted into place*



Irons Out Internal Wrinkles—*Superfinishing of valve stems has been followed at Chrysler by ball-burnishing of valve-guide holes, which produces a smoother, harder, longer-wearing surface. Graphite-in-oil is sprayed into each hole, and then a ball 0.002 in. oversize forced through by a plunger. On the upstroke a second ball drops into the hole and is pressed through. Balls are then washed and stored in a hopper for re-use*

cording to H. J. Klinger, general manager, expects to sell 30 per cent more cars in 1940 than in 1939 when it sold 165,000 units. This will mean a five-day work week for employees during the first three months of 1940, instead of the three and one-half days a week in January and February of 1939 and two days a week in the corresponding period of 1938. Used-car inventories stand at only a 30-day supply, and the unfilled order bank for new cars is the largest ever for January.

For the second successive year Buick attained fourth place in sales for the industry. Production totaled 235,000 cars. Sales were 224,000 units, and reached an all-time record of 83,036 for the fourth quarter. Unfilled orders at this date are twice as great as this time last year.

Chevrolet showed increased strength in new and used car sales in mid-December. New car sales during the second ten days were 2.3 per cent ahead of the first ten, and 4.5 per cent greater than in the second period of November. Used-car sales at mid-month were 13.2 per cent over those in the opening period.

Packard expects to build 50,000 cars during the first half of 1940, according to President M. M. Gilman. The company's total output for 1939 was about 76,700 units. This year it is estimated that 120,000 cars will be manufactured. Up to December 1 Packard deliveries of 1940 models to customers were up 78 per cent from the previous year.

Studebaker is working at maximum production on a single-shift basis. Its backlog and expectant Spring orders will necessitate double-shift operation about the middle of February to produce an estimated 20,000-24,000 units per month. The last quarter in 1939, according to President Paul G. Hoffman, was the most successful in point of sales during the history of the company, when 35,000 cars and trucks were sold.

BUICK TO EXPAND

DETROIT—Buick is reported to be considering an outlay of several million dollars to expand production facilities for 1941. Plans are said to be in a formative state, and no official statement can be expected for several months.

CAR MAKERS CONTINUE TESTS ON PLASTIC BODY MEMBERS

DETROIT—Automobile bodies made entirely from plastic materials are still in the visionary stage, but work is actively in progress on methods to make rear deck lids and roofs of plastic compounds. One manufacturer has made up rear deck lids in quarter size and full size. One of the objections so far has been the showing through of ribs on the finished side. These ribs are criss-crossed on the under side and resemble a grid. Two 1,500-ton presses have been purchased so that studies under production conditions can be undertaken. A press of 2,500-ton capacity is being considered for molding the entire roof. It is argued that these non-load carrying components can be made amply strong with addition of small sheet-metal inserts. It is unlikely that experimental work will be finished for six months.

TOOL & DIE MAKERS EXPAND IN VIEW OF BETTER BUSINESS

DETROIT—Prospects of better tool and die business in the spring, predicated upon the automobile companies making plenty of money, has caused modernization of the facilities of the independent shops.

Faigle Tool & Die Co., formerly at 4200 West Jefferson, Detroit, has been re-established at 6500 Chase Rd., Dearborn. The new plant, will contain 12,600 sq. ft. of floorspace, and will be equipped with approximately 50 per cent new machinery.

Buell Die & Machine Co., 3545 Scotten, Detroit, is adding a structure measuring 50x146 ft. to provide more room for assembly purposes and to relieve congestion in the manufacturing area.

Ground has been broken at Mt. Elliott and Outer Drive, where Congress Tool & Die Co. will have larger quarters for its die-casting division. The new 28,000 sq. ft. structure, being built by the Austin Co., will double the firm's capacity for die-castings used by the automotive trade. The plant will be completed sometime in February.

Local equipment manufacturers have also expanded. Ex-Cell-O Corp. should now be occupying its fourth addition this year, a structure 70x200 ft., which was built in four weeks by the Austin Co. Another Austin project is the new plant being erected for Progressive Welder Co. on Outer Drive, which incidentally is becoming a new industrial center. The Progressive plant will have double the production capacity of the former shop.

CANADA PRIMES FOR PRODUCTION DESPITE LACK OF BIG WAR ORDERS

MONTREAL—Total Canadian war expenditures to September 1, 1940, is estimated at $315,000,000, exclusive of a $48,000,000 contribution to the $600,000,000 three-year Empire airplane pilot training scheme. Most expenditures will be for airplanes, defense works, anti-submarine craft and freight boats. Canadian industrialists expect and are preparing for large-scale production when the character of the war changes and aggression by land and air results in urgent need for replacements.

Airplane production is now at capacity of present facilities. In anticipation of increased orders, Ottawa Car & Aircraft Ltd., National Steel Car, and Cub Aircraft Corp. are all expanding their facilities.

Plane orders by Canada since September involve 125 machines valued around $14,000,000. As yet orders for planes for the Empire pilot training scheme have not been placed, and it is unlikely that they will be concluded for some weeks yet. The first planes will probably come from the United States and Britain. However, Canadian companies are expected to share an order for some 800 elementary training craft for delivery in 1942.

The Air Transport Association of Canada has been pressing the Tariff Board for revision in duties on airplane motor parts to facilitate development of motor production in Canada. At present, motors for Canadian-made planes must be imported from United States and Britain.

British Combine

Woman's Work—*With Britain doing her utmost to boost aircraft production, every available worker is being pressed into service. This girl is drilling and assembling parts of a geodetic fuselage panel for a Wellington bomber*

Britain has placed few orders recently since war equipment is piling up under present intensive home-production schedule. This despite the contention of Canadian industrialists that in event of more destructive warfare, and resultant urgent demand on Canada for war machines, there would be a delay of five or six months to get production started.

New British orders for bombers from Canadian Associated Aircraft are currently under negotiation. This organization currently is assembling bombers under a $10,000,000 contract, the largest British order to date.

Marine Industries, Ltd., Sorel, Que., has been rushing preparations for handling a British order for $1,000,000 of 25-lb. field guns, placed last summer. This order is expected to swell to $5,000,000.

National Steel Car is turning out 12,000 shells weekly, and shortly will start up a new plant to double present capacity.

From the start of the war to November 21, Canada spent $45,000,000 for war materials and defense projects, exclusive of $25,000,000 for railway equipment. This includes $14,000,000 for aircraft, $8,000,000 for clothing and equipment, $4,000,000 for foodstuffs, $1,000,000 for construction projects, $2,500,000 for fuel, $1,500,000 for machinery, $450,000 for motor vehicles, and $5,000,000 miscellaneous. Since then, up to the end of the year, total expenditures have swelled to $56,000,000, spent mostly in Canada.

Exports of Machinery During November, 1939

	November 1939	October 1939	November 1938
Electrical machinery	$9,761,135	$9,555,739	$7,947,853
Power generating machinery (except automotive and electric	1,245,141	1,125,961	1,089,348
Construction and conveying machinery	1,464,916	1,965,494	1,396,215
Mining, well and pumping machinery	3,793,296	4,448,900	4,074,140
Power driven, metal-working machinery	8,604,263	9,121,340	8,044,476
Other metal-working machinery	446,237	464,060	301,162
Textile machinery	825,572	753,869	653,129

Exports of Metal-Working Machinery During November, 1939

Engine lathes	$614,858	$546,071	$672,641
Turret lathes	487,714	764,549	472,778
Other lathes	319,878	335,440	114,946
Vertical boring mills and checking machines	477,673	315,315	230,236
Thread cutting and automatic screw machines	434,957	523,542	434,311
Knee and column type milling machines	518,304	649,627	78,754
Other milling machines	843,427	507,721	1,295,353
Gear cutting machines	468,851	505,383	212,181
Vertical drilling machines	239,293	96,616	15,467
Radial drilling machines	68,922	87,080	60,502
Other drilling machines	95,661	145,239	87,702
Planers and shapers	203,111	192,415	194,432
Surface grinding machines	174,414	279,525	160,724
External cylindrical grinding machines	602,592	430,569	171,665
Internal grinding machines	460,276	458,924	236,955
Tool grinding, cutter grinding, and universal grinding machines	489,133	325,388	202,360
Other metal-grinding machines and parts	361,810	625,358	365,398
Sheet and plate metal-working machines and parts	348,624	487,938	932,404
Forging machinery and parts	351,887	301,243	197,776
Rolling mill machinery and parts	161,368	381,931	795,146
Foundry and molding equipment and parts	130,204	135,600	110,670
Other power-driven metal-working machinery and parts	724,076	1,025,858	1,002,073

Other Metal-Working Machinery

Pneumatic portable tools	107,594	120,293	90,944
Other portable and hand or foor-operated metal-working machines and parts	84,714	112,208	83,766
Chucks for machine tools	30,127	50,454	25,482
Milling cutters, machine-operated threading dies, and taps and similar machine operated metal cutting tools	114,895	55,464	67,338
Other metal-working machine tools and parts	108,907	125,641	33,632

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

Aircraft industry expected to lead machinery show again in 1940. Backlog of plane orders is $680,000,000. Edison as Secretary of Navy leans to new policies.

WASHINGTON — Secretary of the Navy Charles Edison, taking office at New Year, comes into great power, with the billion-dollar expansion under way and a similar increase ready for proposal to Congress. Washington generally looks upon President Roosevelt's choice of the 49-year-old junior Wizard of Menlo Park to head the Navy as all to the good. But some Navy officers are not so pleased. Even radicals, who put high-pressure high-temperature steam power plants in new ships, over protest of hard-shell admirals, are a bit leery of Edison. They fear he will rig their topsides with too much experimental gear. He has already ordered "suicide" (torpedo) speed boats and committed Navy to a lighter-than-air program, to say nothing of throwing three time-honored Navy bureaus together.

Edison's Proposal Jolts Congress

Secretary Edison whipped up choppy water immediately upon taking charge of the navy. Right on the heels of a statement by House Naval Affairs Chairman Carl Vinson that battleships over 45,000 tons were not being considered, Edison said they were *being considered* clear up to 80,000 tons. Vinson at once said the proposal would be studied in connection with the Navy's expansion bill. Then Mr. Edison jolted Congress with a proposal that the President be given power (1) to order ships and materials to meet needs as *defined* by the executive; compliance with such orders would be obligatory; if manufacturers refused or failed to comply the President could take their plants; (2) to modify or cancel all previous orders; (3) require owners to put plants at disposal of the President, who would determine "reasonable prices"; (4) requisition any plants he determines the government may need.

Plane Field Wows Machinery Show

Within the next 60 days, $50,000,000 in foreign aircraft contracts for delivery in 1940 are expected to be signed. The aircraft industry, which so recently was "just a speck in the sky," was easily the star performer in the machinery show of 1939 and it's going to wow the house again in 1940. One authority estimated that deliveries this year will approximate $615,000,000, a gain of 113 per cent over 1939 figures. During 1939 manufacturers booked orders in excess of $700,000,000 for planes, engines and accessories, an amount equal to the total for the previous five years. The backlog of unfilled orders currently is about $680,000,000 as compared with $175,000,000 a year ago. Plant expansions completed or started in 1939 will increase capacity 30 to 40 per cent.

Motor Boat Builders Slighted

Motor boat builders feel that the Navy slighted them in negotiating a $5,000,000 order for about 20 high-speed torpedo boats to be built by Electric Boat Company. Secretary Edison is reported by boat builders to have defended the action on the ground that Congress appropriated $15,000,000 to be spent at the discretion of the President on craft under 3,000 tons, and that bidding was not required. At this writing Navy tells *American Machinist* it has nothing to say officially. Congress is getting letters suggesting an investigation. Navy spent last year about $100,000 in prizes in a competition for American designs of these boats. Edison is reported to have implied that these designs will be considered later.

Asks $16,250,000 for Educational Orders

For educational orders in 1941 the War Department asks, in the budget submitted by the President Jan. 4, a total of $16,250,000. The money is authorized by law, and the appropriation is assured. This is in addition to the $14,250,000 appropriated for 1940. After 1941, $2,000,000 a year is authorized for the years '42, '43, '44, and '45. Of course, war expansion would throw out the educational program as such, and *all* available productive capacity would be put on an education basis.

The War Department is well pleased, with the results of its program thus far. The huge order for Garand rifles from Winchester is said to be one year ahead of schedule, at a saving of about one million dollars out of a total eight million plus. The rifle order, of course, came out of general funds, after an educational order had been financed from the original $2,000,000 educational orders fund. Likewise, the department is much pleased with its gas mask experience; the manufacturers are ready to go on a mass production basis fully six months ahead of schedule.

FEW EDUCATIONAL ORDERS PLACED

WASHINGTON—Less than a million dollars of the $14,250,000 appropriated for War Department educational orders in fiscal 1940 has been spent. The year ends July 1. The bulk of the 1940 orders will have to be placed in the near future. The War Department is firm in its refusal to say which manufacturers are in line or specify what items will be covered. It is reported unofficially that explosives will be among those announced soon.

New Ships To Be Let

Two of the biggest ships under the American flag will be launched in late 1942 or early 1943. The Maritime Commission will call this month for bids on two additional vessels for Pacific service. With the government getting out of foreign transport service, the lines likely to sail the new ships are American President and/or Puget Sound Orient. These boats will cost more than the $15,000,000 "America," because they will have a speed of about 24 knots, and will carry defense features such as gun mounts, with hulls stressed for fire shock. They will emphasize cargo space but have fine accommodations for passengers.

Identical Bids Reported

Iron and steel, exclusive of machinery, won a dubious first place on TNEC's tabulation of identical bidding by industries during the period December 1937 to November 1938. The committee found that identical bids and other monopolistic practices had been present in purchases of $87,326,426 worth of federal supplies. Identical bids were received on one-fourth of all items on which bids were opened during the period. In dollar value, 10 per cent of total purchases were of items on which identical offers were made, according to the report. Of all iron and steel bids, 26.1 per cent were identical; machinery, exclusive of transportation equipment, placed an easy second with 11.7 per cent. Suggested remedial measures include a special investigating agency, stricter enforcement of anti-trust laws, and even such a drastic step as specification by government of top prices.

ALLISON COMPLETES WINDOWLESS AIRCRAFT ENGINE PLANT

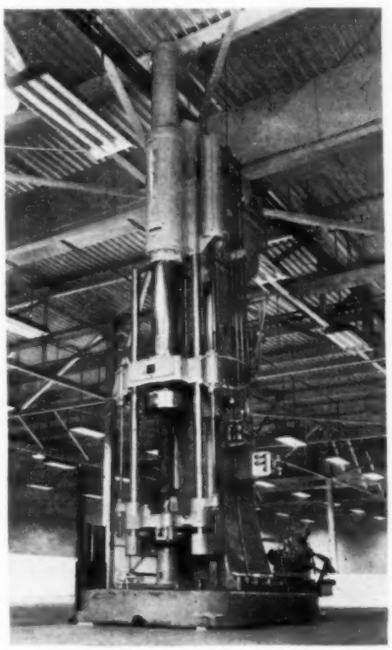
INDIANAPOLIS—After months of planning and construction, Allison Division of General Motors Corporation is ready to move into its "completely controlled conditions" aircraft engine plant here.

Located on a 53-acre site, the new plant is completely air conditioned and equipped with every modern convenience to increase employee comfort and efficiency. An effective temperature of 78 deg. in summer and 70 deg. in winter is maintained by the air conditioning system, which can provide over 400,000 cu.ft. of fresh air per minute. Daylight flourescent lamps produce an average illumination of 30 foot-candles throughout the entire plant, with glare minimized by the large source area and flicker eliminated by operation on three-phase power. The manufacturing building is designed for an average of 1,000 workers and 1,440 hp. of installed motors. Power for all requirements is supplied by diesel-driven generators.

Adjoining the main manufacturing building is the office building, three stories high and also completely air conditioned. Included in this building are the cafeteria, hospital, and doctor's office. Also connected with the main plant is the receiving room, arranged as an air lock to prevent disturbing plant conditions when materials are brought into the building.

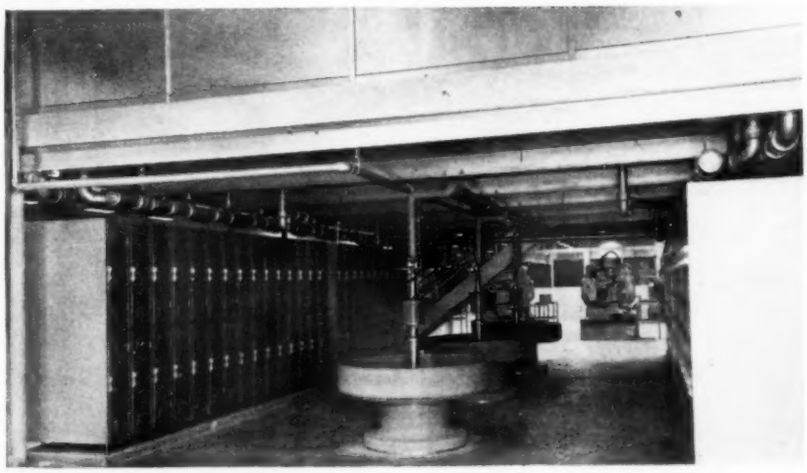
Other structures include the soundproofed test building, the propeller building, and the gate house. All were designed and built by the Austin Company, Cleveland.

Illumination *is provided by 250 kw. of daylight fluorescent luminaires. Three tubes of each unit operate on three-phase power, eliminating flicker*

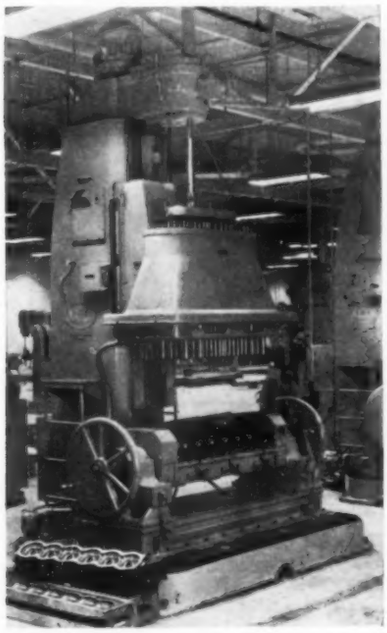


Machines *installed include a Barnes "Hydram," right, which drills a hole over 4 in. in diameter and 28 in. deep in hardened steel in half an hour. Operation used to take several hours*

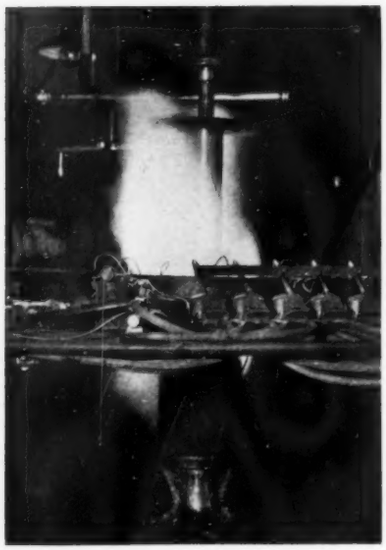
Fixture *built for this boring machine permits greater speed and accuracy*



Washrooms *are the last word in orderliness. Three units like these are located throughout the plant. Toilet facilities are in the mezzanine above*



Wide aisles—*separate this multiple-spindle drill from other equipment*



Inferno—*Harder steel rolls are being produced by a new flame-hardening process developed by Linde Air Products Company, shown above in operation at the Ansonia, Conn., plant of Farrel-Birmingham Company. Known as the vertical combination method, the process is said to result in harder parts having practically no distortion*

$110,000 TO BE SPENT IN 1940 TO FURTHER WELDING RESEARCH

NEW YORK—A $110,000 program of welding research will be carried out in 1940 by the Welding Research Committee of the Engineering Foundation, it has been revealed. More than 70 individual projects now in progress in universities and research laboratories will be continued.

Studies in weldability of steels, weld stresses, structural welding, and progressive failure in steels under repeated stresses will be emphasized. Economies in the production of machinery, prefabricated houses, ships, office furniture, automobiles, and railroad equipment are among the goals hoped to be achieved through knowledge gained from the studies.

SAFETY CONGRESS TO MEET

CHICAGO—The National Safety Council has chosen Chicago for its 29th National Safety Congress & Exposition, which will be held Oct. 7-11 with headquarters at the Stevens Hotel.

The 1940 program provides for 140 distinct sessions and for 500 different speakers. Every phase of accident prevention—industrial, traffic, home, school, farm, aviation, railroad and marine—will be covered. Manufacturers of safety products will have more than 125 exhibits. Over 10,000 safety leaders from various countries are expected to attend.

PERSONALS

GEORGE A. BLACKMORE, president of Westinghouse Air Brake Co. and of Union Switch & Signal Co., has been elected a director of Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

FRANKLIN H. FOWLER, recently president and operating head of Foote Bros. Gear & Machine Corp., Chicago, Ill, has been appointed assistant to the president and executive head of operations of American Machine & Metals, Inc., East Moline, Ill.

WILLIAM E. LEIGH, former vice-president International Telephone Development Co., subsidiary of International Telephone & Telegraph Corp., has retired to become associated with the British Purchasing Commission.

D. F. MCCANDLISH, former manager of the Oklahoma City district of Air Reduction Sales Co., New York, N. Y., has been appointed manager of the Detroit district.

ARTHUR W. PAGE, vice-president American Telephone & Telegraph Co., has been elected a director of Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

ROBERT A. JONES has been appointed New York district engineer for the General Electric Co., Schenectady, N. Y.

U. S. Government Contracts Awarded to Metal-Working Firms

(Machine Tool Awards on Page 26d)

Contractor	Gov't Agency	Commodity	Amount
Wire Rope Corp. of America, New Haven, Conn	Navy	Wire rope	$35,370
Treadwell Engineering Co., Easton, Pa	Navy	Gun saddles	36,850
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa	War	Gas holder	25,890
American Brass Co., Waterbury, Conn	Ordnance	Cartridge cups	20,840
Caterpillar Tractor Co., Peoria, Ill	Navy, Procurement	Tractors	107,485
Struthers-Wells-Titusville Corp., Titusville, Pa	Navy	Steering gear	87,312
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa	Navy, TVA	Electrical equipment	114,220
Bendix Aviation Corp., Scintilla Magneto Div., Sidney, N. Y	Navy Yard	Magnetos	54,438
General Electric Co., Schenectady, N. Y	Engineers, Air Corps, Navy	Electrical equipment	99,421
Ne Page Electric Co., Seattle, Wash	Engineers	Switchboards	36,815
R.C.A. Mfg. Co., Camden, N. J	Signal Corps	Radios, parts	861,509
Connecticut Telephone & Electric Corp., Div. of Air Appliances Corp., Meriden, Conn	Signal Corps	Electrical equipment	27,675
American Automatic Electric Sales Co., Chicago, Ill	Signal Corps, Navy, Panama Canal	Telephone equipment	56,797
Ideal Electric & Mfg. Co., Mansfield, Ohio	Navy	Generator sets	54,816
Collyer Insulated Wire Co., Pawtucket, R. I	Navy Yard	Wire, cable	64,877
International Engineering, Inc., Dayton, Ohio	Air Corps	Lamp assemblies	24,678
Edison General Electric Appliance Co., Chicago, Ill	Navy	Electrical appliances	22,399
Phelps Dodge Copper Products Corp., Habirshaw Cable & Wire Div., Yonkers, N. Y	Navy	Electric cable	85,705
United Aircraft Corp., Pratt & Whitney Aircraft Div., East Hartford, Conn	Navy	Engines	847,501
Variety Aircraft Corp., Dayton, Ohio	Air Corps	Propeller blades	42,600
Bendix Aviation Corp., Bendix Products Div., South Bend, Ind	Navy Yard	Aircraft accessories	98,986
Wright Aeronautical Corp., Paterson, N. J	Navy Yard	Crankshafts	36,514
Cleveland Pneumatic Tool Co., Cleveland, Ohio	Navy Yard	Landing gear struts	83,232
Steel Products Engineering Co., Springfield, Ohio	Air Corps	Propeller hubs	30,690
Bausch & Lomb Optical Co., Rochester, N. Y	Navy	Binoculars	29,280
Bendix Aviation Corp., Pioneer Instrument Div., Bendix, N. J	Navy	Aircraft octants	227,075
American Gas Accumulator Co., Indianapolis, Ind	Coast Guard	Acetylene cylinders	51,795
American Locomotive Co., Railway Steel Spring Div., New York, N. Y	Ordnance	Bomb bodies	25,509
Gilbert & Barker Mfg. Co., Springfield Mass	Ordnance	Water chests	28,727
Edward G. Budd Mfg. Co., Philadelphia, Pa	Navy	Doors, hatches	68,232
Crane Co., Chicago, Ill	Navy	Valves	24,437
Graybar Electric Co., Kearney, N. J	Signal Corps	Crystal unit coil set	93,880
Standard Transformer Co., Warren, Ohio	Navy	Transformers	23,630
Circle Wire & Cable Corp., Long Island, N. Y	Panama Canal	Insulated cable	26,001
United Aircraft Corp., Vought-Sikorsky Aircraft Div., Stratford, Conn	Navy	Airplane parts	2,601,586
Stewart-Warner Corp., Chicago, Ill	Ordnance	Ammunition parts	159,080
Scovill Mfg. Co., Waterbury, Conn	Ordnance	Ammunition parts	121,260
Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J	Ordnance	Aircraft instruments	428,817
United Aircraft Corp., Hamilton Standard Propellers Div., East Hartford, Conn	Air Corps	Propeller assemblies	1,148,009
Rauland Corp., Chicago, Ill	Signal Corps	Radios	189,046
J. H. Bunnell & Co., New York, N. Y	Signal Corps	Timing apparatus	30,236
United States Motors Corp., Oshkosh, Wis	Signal Corps	Power units	34,564
Teletype Corps., Chicago, Ill	Signal Corps	Teletypes	37,076
Becton, Dickinson & Co., Rutherford, N. J	Medical	Surgical instruments	38,542
S. Blickman, Inc., Weehauken, N. J	Medical	Hospital equipment	64,588
S. S. White Dental Co., New York, N. Y	Medical	Dental supplies	62,836

CHARLES W. DEEDS, president Chandler-Evans Corp., Meriden, Conn., aircraft parts manufacturer, has been elected a director of Niles-Bement-Pond Co., Hartford, Conn. Also named directors were HUBERT D. TANNER and CHARLES M. POND, who last year were elected vice-presidents of the latter organization. Mr. Tanner, who has been with the company for 20 years, is in charge of the machinery division. Mr. Pond, for the past 31 years associated with the organization, heads the small tool and gage division.

DR. WILLIAM A. MUDGE, for the past seventeen years superintendent of research, superintendent of the refinery and works metallurgist at the Huntington, W. Va., rolling mill of International Nickel Co., New York, N. Y., has been transferred to the technical service division of the New York office.

H. D. RYKER, assistant works manager Lockheed Aircraft Corp., has been made general manager of Vega Airplane Co., a subsidiary.

HAROLD W. STODDART has been appointed manager of the turbine well pump division of Worthington Pump & Machinery Corp., Harrison, N. J. For the past twenty years associated with the company, Mr. Stoddart was formerly assistant manager of the division.

T. T. SULLIVAN, former secretary-treasurer and vice-president of Stewart-Warner Corp., Chicago, Ill., has resigned as secretary-treasurer. For the past 28 years associated with the corporation, Mr. Sullivan will continue in his present capacity as a vice-president and director.

JOHN A. ZELLERS, vice-president Remington Rand, Inc., Buffalo, N. Y., has been elected president of the New York Board of Trade.

CHARLES M. POND

HUBERT D. TANNER

CHARLES W. DEEDS

BUSINESS ITEMS

Central Tool & Equipment Co., Ltd., Central House, Upper Woburn Place, London, W. C. 1, England, wishes to contact American manufacturers of machine tools and sheet metal-working machinery who are not represented in England.

Emsco Derrick & Equipment Co., Los Angeles, Calif., is erecting a $10,000 addition to its shop.

Field Force Mfg. Co., Elmira, N. Y., manufacturers of "Ospraymo" and "Field Force" sprayers, has moved to Pottstown, Pa.

Clearing Machine Corp., Chicago, Ill., is adding approximately 10,000 sq.ft. of floor space in its fourth plant addition in six years. General expansion of company business is the principal reason given by R. W. GLASNER, president.

General American Aerocoach Co., recently organized in Chicago, Ill., a subsidiary of General American Transportation Corp., has begun production of an all-welded light-weight motor coach.

Johnson & Johnson, New Brunswick, N. J., surgical goods manufacturer, is building a 56,000-sq.ft. plant in Chicago, Ill., for the manufacture of gas masks. Plant is scheduled to begin operations around the first of April.

Linde Air Products Co., New York, N. Y., is building a $40,000 office and warehouse in Los Angeles, Calif.

Micromatic Hone Corp., Detroit, Mich., has leased additional space, practically doubling the space formerly occupied. Added machinery has substantially increased its production capacity.

Nelson Muffler Corp., Stoughton, Wis., manufacturer of truck, tractor and motorcycle mufflers, has moved its plant into new and larger quarters.

Rawlplug Co. New York, N. Y., has appointed WILLIAM and WALTER SCHMITT, Irvington, N. J., as representatives.

Reo Motor Car Co., Lansing, Mich., has been reorganized and is planning to resume operations, manufacturing motor trucks only.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has been appointed distributor of McKay certified stainless steel electrodes.

Portland Mfg. Co., Portland, Mich., automotive parts manufacturer, has awarded a contract to the Austin Co. for the design and construction of a welded rigid frame factory providing 16,000 sq.ft. of floor space.

Simmons Machine Tool Corp., Albany, N. Y., has declared a bonus of $20,000 to be distributed among 200 employees. Company is planning a new building adjoining its present structure to accommodate increased business. "We have been busier than ever in our history, working 24 hours a day for the last three months," declared Charles A. Simmons, Jr., vice-president. "We have enough orders ahead to last for ten months, and they are still coming in."

Standard Pressed Steel Co., Jenkintown, Pa., is erecting an addition to its main plant providing 12,000 sq.ft. of floor space. New structure is of steel, brick and glass construction.

Standard Tool & Die Corp., Milwaukee, Wis., has moved its plant to 6822 W. Burnham St., West Allis, Wis.

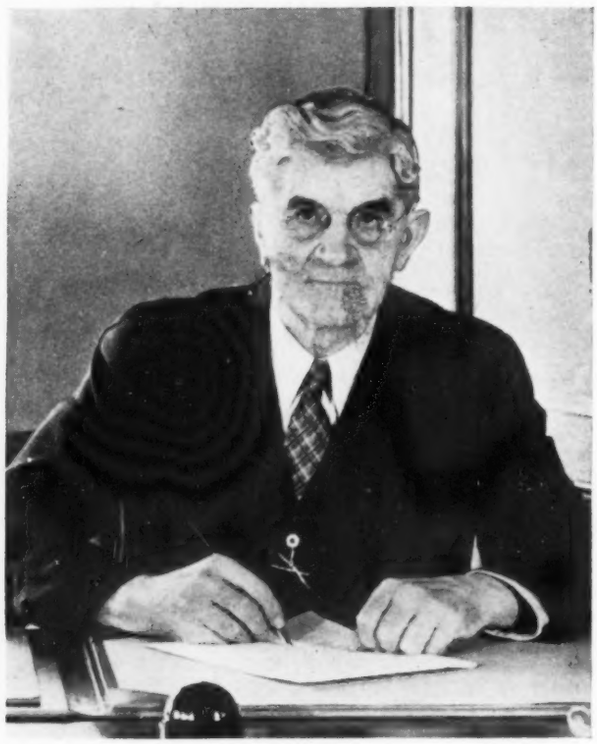
Timm Aircraft Corp., Los Angeles, Calif., has completed a plant addition designed to hold the largest baking oven ever constructed for processing plastics. Two additional buildings are planned, which will house all other plastics operations involved in the production of the company's plastic airplanes, which is scheduled to begin shortly after Feb. 1.

Vultee Aircraft Mfg. Co., Downey, Calif., has started construction on two factory buildings measuring 181x163 ft. and 360x294 ft. and costing around $300,000.

Wisconsin Axle Co., a subsidiary of Detroit-Timken Axle Co., Detroit, Mich., has purchased the property of the J. L. Clark Mfg. Co.

Wyckoff Drawn Steel Co., Pittsburgh, Pa., has appointed C. GRINDROT as sales engineer in the Chicago territory.

J. E. FRANTZ PASSES AWAY



J. E. FRANTZ

WAYNESBORO, Pa.—J. E. FRANTZ, president of the Landis Tool Company, died December 16 following an extended illness. He was 72 years of age.

Mr. Frantz first became associated with Landis Brothers in 1890, shortly after they had begun the manufacture of the first Landis grinders. When the plant was destroyed by fire in 1897, he was largely responsible for the formation of the present organization, becoming its first secretary and treasurer.

In 1906 Mr. Frantz was named general manager, and in 1925 he became president of the company, which office he held until the time of his death. During his connection with the organization he saw employment grow from six workers to almost 1,500 as he led the company to its present position in the metal-working industry.

For years Mr. Frantz was one of the country's leading machine tool manufacturing executives. Always keenly interested in the affairs of his community, he served as a director of numerous local organizations, among which were the First National Bank & Trust Company, Waynesboro Hospital, and the Pennsylvania State Chamber of Commerce.

In spite of a busy career, he was never too occupied to discuss problems with his employees, his fellow-citizens, and his other friends. His long years of experience and penetrating foresight made his opinions much sought and respected. His loss will be felt not only by the organization with which he has so long been identified but also by the community as a whole.

OBITUARIES

EDWIN W. ALLEN, since 1926 a vice-president of the General Electric Co., Schenectady, N. Y., died Jan. 1 in a Baltimore, Md., hospital where he had been under treatment for two months following an operation. He was 61 years of age.

Mr. Allen first entered the employ of the company in 1901 as a student engineer, and ten years later was appointed engineer of the central district, with headquarters in Chicago. In 1924 he was transferred back to Schenectady as manager of the engineering department, and two years later was elected a vice-president. He was a fellow of the American Institute of Electrical Engineers and a member of the Western Society of Engineers.

HENRY G. DALTON, chairman Youngstown Sheet & Tube Co. and president of Interlakes Steamship Co., Cleveland, Ohio, and who began his career in the steel industry at the age of sixteen by checking freight, died Dec. 27 following an emergency operation for appendicitis. He was 77 years of age.

WILLIAM U. FOLLANSBEE, 79, co-founder Follansbee Bros. Co., Pittsburgh, Pa., steel producer, died Dec. 19.

GUSTAV A. KOSCHIN, 65, founder and president of the Koschin Co., Milwaukee, Wis., designers and builders of electrical machinery, died Dec. 15.

CONRAD R. SCHUMACHER, 62, founder and chairman of the board of Conrad Razor Blade Co., Long Island City, N. Y., died Dec. 20 at his home in Lynbrook following a three months' illness.

FRANCIS J. SHIRLING, manager of factory service at the East Pittsburgh works of the Westinghouse Electric & Mfg. Co., died Dec. 22 of a heart attack. He was 62 years of age, and had been associated with Westinghouse for the past 45 years.

HUGH L. WARNER, 73, a founder of the Warner Gear Co., Muncie, Ind., and prominent in the development of automobile differentials, died Dec. 28 in Highland, Mich.

HENRY L. WRATTEN, 79, president Racine Boiler & Tank Co., Racine, Wis., died Dec. 18.

MEETINGS

AMERICAN ENGINEERING COUNCIL. Annual meeting, Mayflower Hotel, Washington, D. C., Jan. 11–13.

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual convention, Grove Park Inn, Asheville, N. C., May 20–22.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Winter convention, New York, N. Y., Jan. 22–26.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Annual meeting, Blackstone Hotel, Chicago, Ill., Jan. 16–18.

CANNING MACHINERY & SUPPLIES ASSOCIATION. Annual meeting, Stevens Hotel, Chicago, Ill., Jan. 22–26.

INSTITUTE OF SCRAP IRON & STEEL. Annual meeting, William Penn Hotel, Pittsburg, Pa., Jan. 9–11.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting and engineering display, Book-Cadillac Hotel, Detroit, Mich., Jan. 15–19. National aeronautic meeting, Washington Hotel, Washington, D. C., March 14 and 15. National transportation and maintenance meeting, Mellon Institute, Pittsburg, Pa., March 28 and 29.

WASHER & IRONER MANUFACTURERS ASSOCAITION. Annual meeting, Chicago, Ill., Jan. 10.

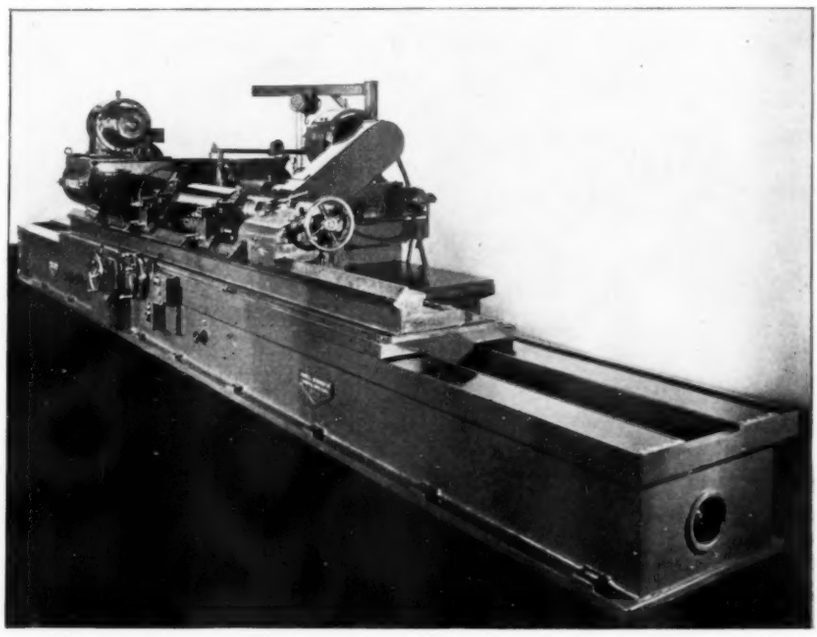
SHOP EQUIPMENT NEWS

Farrel-Birmingham Cylindrical Grinder Permits Grinding Close to Shoulders

Type TT cylindrical grinder developed by Farrel-Birmingham Co., Inc., Ansonia, Conn., incorporates a traveling work table and a fixed grinding wheel unit. It is equipped with a sensitive reversing mechanism which permits grinding up to the shoulder of a shaft. Once set, the traverse and reversal of the traveling table are automatic, and require no further attention from the operator.

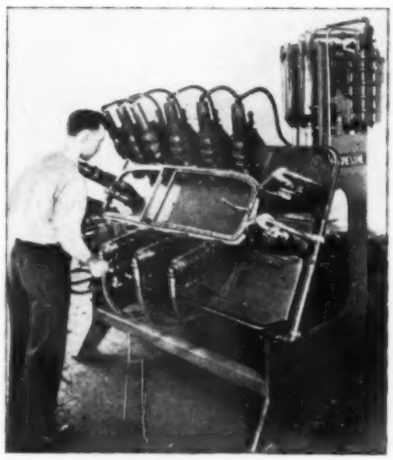
All mechanical and electrical operating controls are within easy reach of the operator's station, and are so arranged that he has complete control of the grinding without leaving this position. To permit moving the traveling table by hand, a handwheel and clutch are provided. There also is handwheel control for hand feed of the grinding wheel, as well as electrical controls for rapid in-and-out movement of the wheel head. Traveling table may be reversed by hand or automatically. Lever contact control is provided for rapid traversing the table. Start and stop pushbutton stations control motors driving the grinding wheel, the table and the water pump. A start-jog-stop station controls the headstock.

Design of the worktable drive has been improved to secure positive, vibrationless traverse. The table is driven by an adjustable speed reversing motor through a two-speed drive having double helical gears. Reversal of the table is accomplished electrically, eliminating mechanical reversing clutches. Seven motors are required, eight if a taper grinding mechanism is incorporated in the machine. Grinding wheel and headstock are driven through V-belts.



Progressive Punch Units Are Spring Balanced

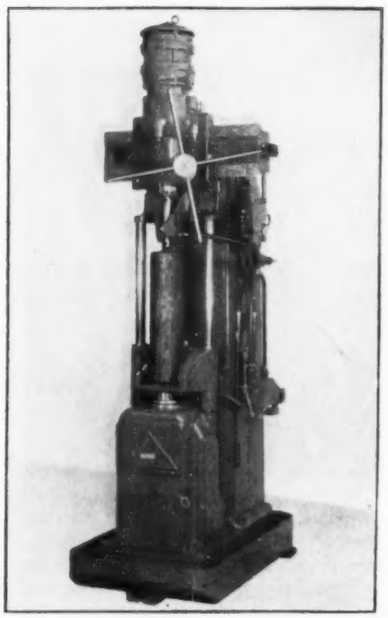
Hydraulic punching units employing a balanced spring principle are offered by Progressive Welder Co., 701 Piquette Ave., Detroit, Mich., for mounting singly or in groups as required. The punching fixture shown comprises 12 to 16 individual hydraulic punch units (according to the number of holes), a nesting form for the work, and an air-hydraulic booster to operate the punching units, arranged especially for punching metal moldings. While the units are of single-acting construction, actual operation is in two directions. When hydraulic pressure is first admitted to the unit, the piston moves toward the work, bringing a die into contact with the work and holding it securely against the nesting form. As the forward movement ceases, pressure increases within the cylinder, causing the cylinder to move away from the piston against spring pressure. To the cylinder of the unit is connected the punch and counterpunch which, thus, pierce the work from the far side. In operation, hand clamps at each end of the nesting form position the work until the operator presses the starting button. Immediately the dies contact the work, clamping it securely in the nesting form, the resulting back pressure trips the main pressure switch to bring the hydraulic booster into full action to complete the punching. When the stroke is completed and the pressure relieved, stripping spring retracts punch from work, the nesting form acting as a stripping plate. Following return of the carriage to normal position, the piston spring moves the piston into original position.



LeMaire Centering Machine Rotates Shell for Accuracy

LeMaire Tool & Mfg. Co., 2657 S. Telegraph Rd., Dearborn, Mich., has developed this machine especially for centering shells. While designed primarily for the first operation, it can be used for recentering operations. For first operation work, the shell is held from the rough forged hole on an arbor by means of two sets of three expanding locators at the top and bottom of the hole. An outstanding feature is the use of an inverted spindle for rotating the shell while performing the centering operation. This keeps the center concentric with the hole in the shell. Also, by rotating the shell in a vertical

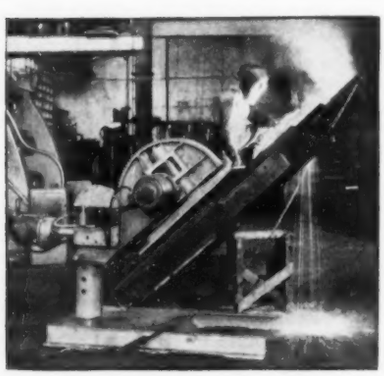
position any tendency for it to wobble is eliminated. An elevating platform is used for lowering the shell over the arbor to facilitate loading and to avoid bumping it while loading. The uppermost position of the platform is on a level with the conveyor. All



movements are by hydraulic power, except cutting the center, which is done manually. The machine shown is arranged for a 6-in. shell. With slight modification, it can be used for other sizes. For smaller sizes it is furnished without elevating platform.

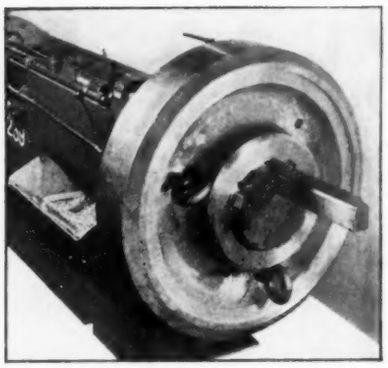
Cullen-Friestedt Positioner Has Power-Operated Table

Model 60 welding positioner offered by Cullen-Friestedt Co., 1300 S. Kilbourn Ave., Chicago, Ill., has capacity of 6,000 lb. when center of gravity of load is 12 in. from the face of the table and 6 in. to one side of the axis of rotation. Both table tilt and table rotation movements are power-operated, each having its own motor and control. Table can be rotated through a full circle, regardless of the angle at which it is tilted. It can be tilted through an arc of 135 deg. from horizontal position. Gears for rotating and tilting the table are self-locking in all positions. Height of table is adjustable from 42 to 54 in. on machines with standard bases. All mechanism is below the table and does not interfere with the work, regardless of the position of the table.



Colonial Index Fixture Simplifies Spline Broaching

Production of accurate splines in large wheels and gears in limited quantities is facilitated through the use of an indexing fixture developed by Colonial Broach Co., 147 Jos. Campau, Detroit, Mich., for use on a standard Colonial universal horizontal broaching machine. Essentially,



this equipment consists of an accurate index plate mounted on the faceplate of the machine. Broaches are pulled through the work. Each spline is completed in turn before indexing to the next position.

Improved Ex-Cell-O Precision Borers Incorporate New Hydraulic Controls

The line of "Junior" and "Senior" precision boring machines made by Ex-Cell-O Corporation, 1224 Oakman Blvd., Detroit, Mich., has been redesigned, and now incorporate an improved hydraulic control. Table movement is controlled automatically after starting by adjustable table dogs below which, in the top of the panel at the front of the machine, are five hydraulic control plungers. At each side of the control panel are three graduated orifice dials. The upper two dials on each side control the rate of the first and second feeds in that direction of table travel. The lower dials on each side control the dwelling time at each end of the table stroke. Manual starting is controlled by a lever, and manual direction control is by knob in the middle of the panel.

The hydraulic system provides a constant rate of rapid traverse and

two adjustable feed rates in each direction of table travel. A choice of either immediate table return or, with the use of table stops, an adjustable dwell and return is available. The control also provides for automatic jump feeding, or rapid traverse between two feeding cuts. Provision is made on the machine base for connecting hydraulically operated fixtures and spindle chucks to the pressure and exhaust lines in such a way as to coordinate their operation automatically with the table cycle. Dogs on the rear of the table may also be used to control starting and stopping of the spindles and of coolant flow. Hydraulic pressure is supplied by motor and pump mounted on a separate rubber-insulated base on the floor at the rear of the machine. Connections to the machine system are by flexible lines so as to eliminate the transmission of pump vibration.

As on previous machines, ways under the table are long enough to cover the base ways at each end of the stroke. Bridges can be adjusted endwise on the machine base rails to reduce lost time and motion in table travel. Spindles can be mounted on the bridges at any angles to the line of table travel for taper boring and taper turning. From one to four spindles can be mounted on a bridge, giving a wide range of spindle center distances. A universal fixture may be used for handling a wide range of parts, and for small lots with frequent change-over. For production runs the machine is more economically equipped with a single-purpose fixture which can be hand, hydraulically or air operated.

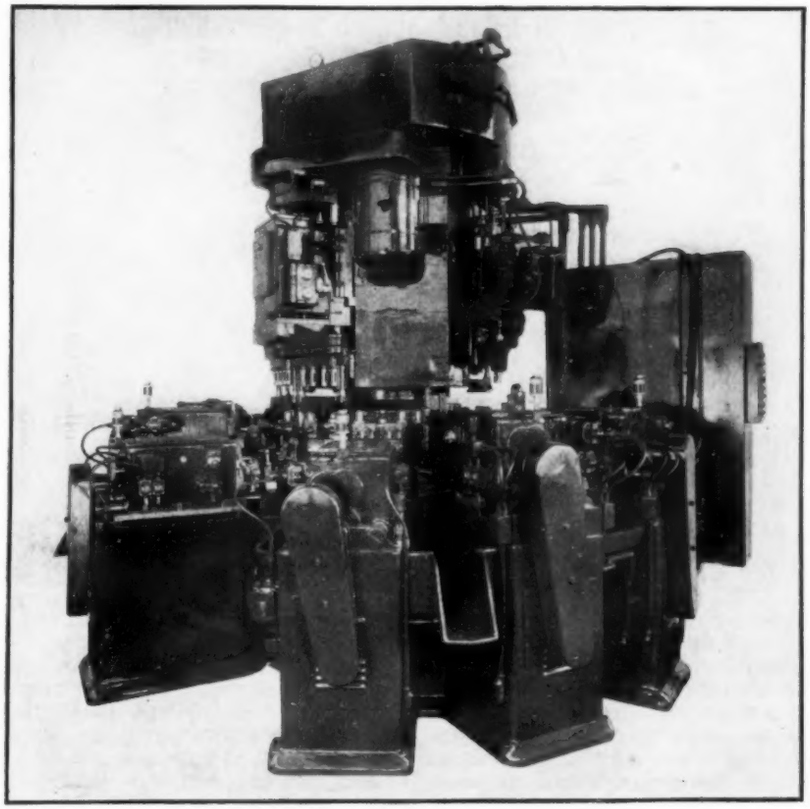
Capacity of the "Junior" precision machine is ⅜ in. minimum and 6 in. maximum diameter hole; 12 in. maximum table travel; ½ to 40 in. per in. table feed and 15 ft. per min. rapid traverse. The "Senior" machines provide for boring holes to 8 in. maximum diameter; have 16 in. (single end) and 15 in. (double end) maximum table travel; ¼ to 18 in. per min. table feed; and 10 ft. per min. rapid traverse.

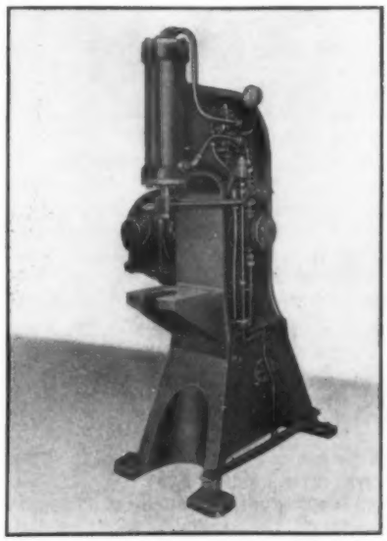
Snyder Station-Type Machines Mill, Drill and Ream Forgings

Two special station-type machines have been built by Snyder Tool & Engineering Co., 3400E. Lafayette St., Detroit, Mich., for straddle milling, drilling and reaming the hanger boss on the rear-axle housing flange forging for a 1940 automobile. Production per machine is estimated at 180 flanges per hour. The entire base and column are of welded-steel construction, vertical and horizontal heads moving on slides.

Parts are loaded into the vertical seven-station fixture, two parts being positioned at each station. A pivoted, motorized wrench can be swung to engage either one of the two fastening nuts at each station. Indexing of the fixture is controlled with a Geneva motion in the base, this mechanism having its own motor drive and control.

The sidehead straddle mills the bosses, while the vertical head drills and reams the boss holes. Reaming spindles are advanced to the work at an accelerated traverse by means of a special cam and gearing. Feed and return of reaming spindles are accomplished without the use of springs. A sump for hydraulic oil is located in the upper part of the column. Feeds for the two heads are powered by individual pumps and hydraulic circuits, Vickers equipment being used.





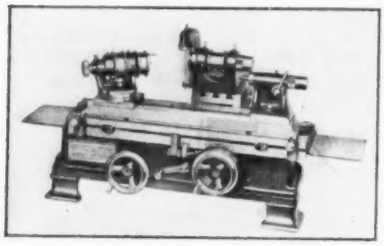
Greenerd 10-Ton Press Completely Self-Contained

The completely self-contained 10-ton hydraulic press announced by Greenerd Arbor Press Co., P. O. Box 415, Nashua, N. H., can be equipped with a 10 hp. motor to give a constant speed of the ram under full pressure of 208 in. per min., with a return speed of 280 in. per min. With a 5 hp. motor, the press has a constant speed of 88 in. per min. When equipped with a 5 hp. motor and a double pump, the press has a working speed of 88 in. per min. at pressures of 4 to 10 tons and a rapid traverse up to 4 ton pressure at the rate of 222 in. per min. The basic No. H-58 press shown will receive parts to 15 in. diameter with a height of 16 in. over the plate. Ram movement is 16 in.

Crystal Lake Bench Grinder Arranged for Belt Drive

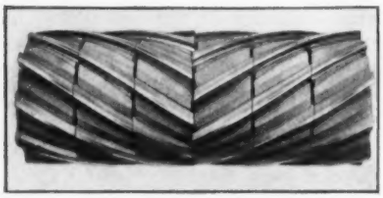
The "Universal" bench grinder for production, tool and experimental work made by Crystal Lake Machine

Works, Crystal Lake, Ill., is fully adjustable for a wide range of operations. Grinding wheel head and platen can be swung horizontally through complete circle and has provision for fine adjustment in clamping. Feeds of 0.037 and 0.300 in. per turn of handwheel are provided. A micrometer stop on the platen provides for positive sizing of the work. The 27-in. long table travels ½ in. for each turn of handwheel. Table can be swivelled to 7 deg. either way. Headstock can be swivelled horizontally for a full circle and can be equipped with an 8 in. face plate or a 4-in. four-jaw independent chuck. Collet capacity of the headstock is ½ in. Four changes of work speed are provided. An overhead belt drive arrangement is available.

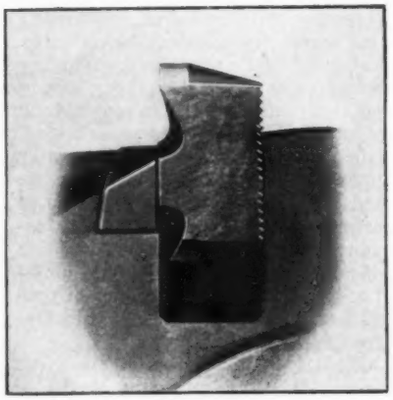


"Go & Go" Slabbing Cutter Features Double-Life Blades

A double-life blade has been incorporated in the improved sectional slabbing cutter developed by Goddard & Goddard Co., Inc., 12280 Burt Rd., Detroit, Mich. The cutter body is made from an alloy steel heat-treated for toughness and strength. As an added feature, the holes are chrome plated to resist wear over a long period of time. The body is made in 4 in. wide sections which are easy to handle and are sharpened like a solid cutter. Each inserted blade has a flute milled on each side, each side providing the usual full grinding life of an ordinary blade so that when one side of the blade is worn down to the body through repeated grindings, the blades may be turned bottom side up to present a completely new cutting edge. The flute on one side of the blade is of right-hand helix, while the other side is left-hand. When the blade is worn out in a right-hand body it is transferred to a left-hand body and vice versa. Thus it is necessary to carry only one type of blade in stock to service both right and left-hand cutters. Because of a blind serration, there is only one position into which the blade can be assembled with either side out. Blades are securely anchored into place by a taper dovetail wedge. These cutters are available in 8½ to 11 in. diameters with from 10 to 14 blades per section. Maximum hole size ranges from 3 in. for an 8½ in. cutter to 5 in. for an 11 in. cutter.



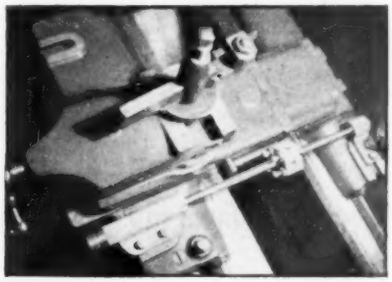
Ends of blades are staggered in each section of this "Go & Go" heavy-duty slabbing cutter to prevent leaving a fin on the work



Inserted blades for the slabbing cutter have a double cutting edge. When one side has been used up the blade is reversed and inserted in a body section of the opposite hand

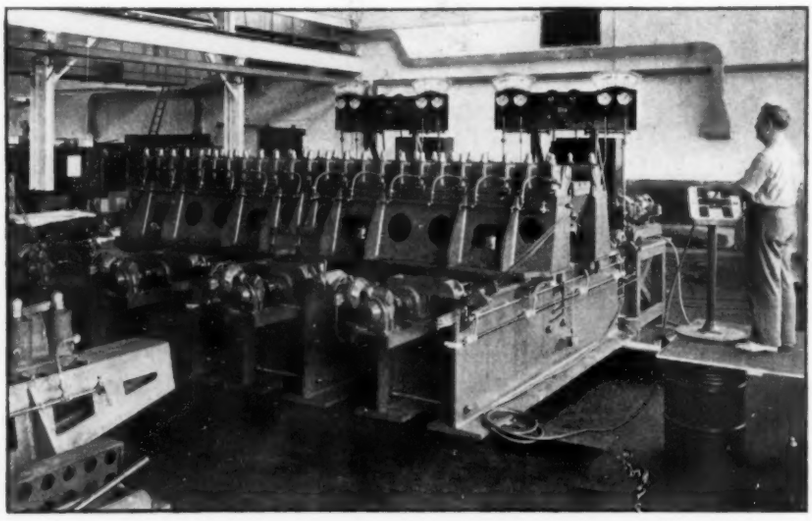
Portman Cross-Slide Stop Mounts on Engine Lathes

The multiple-diameter cross-slide lathe stop introduced by Portman Machine Co., 2236A Bathgate Ave., New York, N. Y., can be fitted to the wings of the carriage of any lathe. It consists of an indexing head and four-way cross-slide and rear bearing support. In operation, after a piece of work has been turned to the various diameters, setscrews on the cross-slide are set in position.



Duplicate pieces then can be turned without continuous measuring of diameters. Several sizes are available to fit lathes from bench models to large sizes.

"Erco" Hydraulic Stretching Press Has Motor-Driven Supports and Inclinable Table

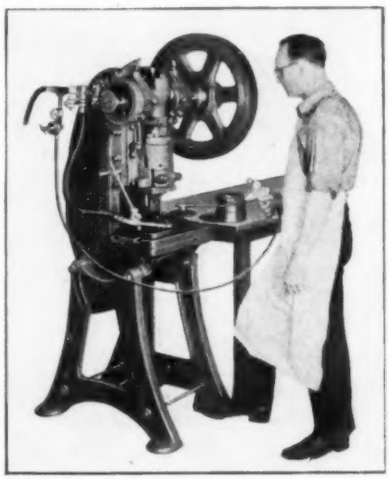


The hydraulic stretching press shown here assembled on the test floor consists of two "Erco" 300-ton hydraulic stretching units coupled in tandem to provide a total capacity of 600 tons for forming sheet metal by forcing a die upward into the work while the two edges of the sheet are restrained in clamps. Built by Engineering & Research Corp., Riverdale, Md., this machine consists of two standard HYSP-2-300 stretching presses, each of which has two cylinders, two plungers and a common

inclinable table. Each press also has two motor-driven clamp supports each provided with six sheet clamps. To enable swivelling each support is arranged for individual motor drive to each end. Maximum stroke is 12 in. and operating pressure is 0 to 3,000 lb. per sq. in. Speed of hydraulic pistons is variable from 0 to 17 in. per min. at no load and from 0 to 10 in. per min. at 3,000 lb. per sq. in. pressure. Maximum distance between clamps is 80 in. while minimum distance is 24 in. Standard table for the HYSP-2-300 press measures 17 in. wide and 97½ in long. Total length of clamps is 99 in., each clamp being 16 in. long. Individual clamps can be swivelled on supports, the maximum movement of any clamp end on supports being 5 in. The sixteen clamps can be swivelled up to 10 deg. Distance from floor to clamps is 42¾ in.

Littell "Pres-Vac" Feeders Safeguard Press Operators

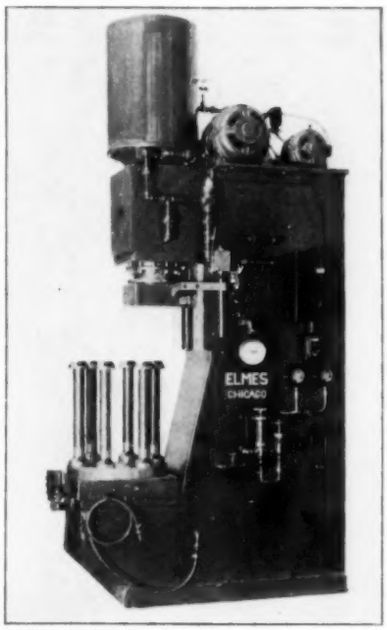
A line of safety feeders and mechanical pickers has been introduced by the F. J. Littell Machine Co., 4163 Ravenswood Ave., Chicago, Ill., in order to keep operator's hands out of "danger zone" of press and so prevent accidents. The "Pres-Vac" safety



feeder is used for picking up flat-surface materials and feeding them into punch presses. It consists of a pistol-grip handle and a single or double vacuum cup attached to an extension long enough to permit feeding materials into the press while keeping hands out of danger zone. When the trigger of the handle is pulled, a vacuum is secured between the cup or cups and the materials handled. The picker is attached to a compressed air line and requires a pressure of 20 to 45 lb. For picking up pieces not suited for handling with a vacuum lift, a line of mechanical pickers is available. These are air operated and can be fitted with various types of jaws to suit the work handled. Aluminum jaws protect dies should picker be caught between punch and die in the press.

Elmes Metal Marking Press Controlled by Pushbuttons

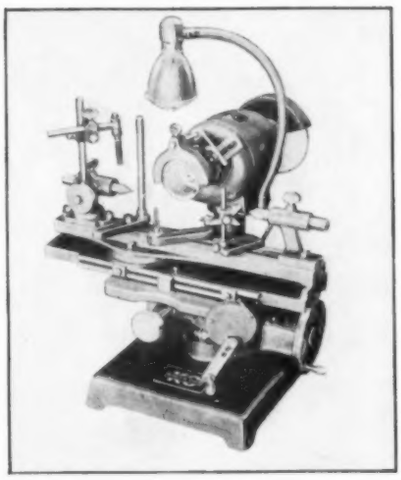
Up to 20 markings per minute are possible in the hydraulic metal marking press announced by Charles F.



Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill. This press will die stamp any marking on metal pieces of a wide range of sizes and shapes. Operation is fully automatic and is controlled by pushbuttons. There are six stations on the turntable, which may be moved independently of the ram. The machine is arranged so that it will not stamp a blank mandrel. Pressure may be released at a pre-determined tonnage, or after the die has marked the work to a specified step.. Range of pressure is controllable from 15 to 100 tons. Machine is self-contained.

Lee Tool and Cutter Grinder Handles Large Jobs

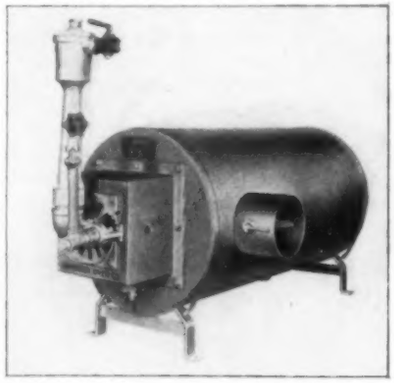
"Knock-Out" Model A-270 tool and cutter grinder offered by K. O. Lee & Son Co., Aberdeen, is a complete tool sharpening machine of bench-type capable of doing large and small jobs. It will swing 5 in. over table, 16 in. between centers. Longitudinal feed is 11 in. and cross feed is 3½ in. Vertical feed is 6½ in. The ¼ hp., 3,450 r.p.m. motor is mounted on a swivel head. Grinding wheels may be



mounted on either end of the motor. A 6-in. wheel can be used on top of a 5-in. cutter. Compound table can be swiveled in a complete circle and is graduated by degrees and taper per foot.

Gas-Fired Air Heater Has Controlled Combustion

Type DG direct gas-fired air heaters offered by Despatch Oven Co., 622 Ninth St. S. E., Minneapolis, Minn., feature controlled combustion which incorporates a back-pressure

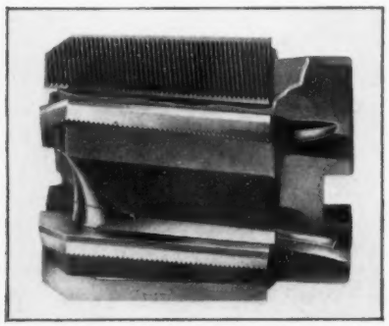


baffle arrangement that assures maximum operating efficiency. Made in capacities from 75,000 to 1,000,000 B.t.u. per hr., these air heaters are recommended for converting ovens, dryers and furnaces into high-speed units with maximum operating temperature of 1,250 F.

Large Chip Space in "Go & Go" Hogging Reamers

Available in both shell and shank types, heavy-duty hogging reamers offered by Goddard & Goddard Co., Inc., 12280 Burt Rd., Detroit, Mich., feature a large chip space which is rounded and polished for free chip

flow, and heavy blades tapered on the bottom to provide grinding stock so that diameter can be maintained by adjusting the blades accurately. Radial serrations prevent endwise blade movement when cutting and provide for positive adjustment of diameter. Taper dovetail wedges



lock the blades into place. Shank type hogging reamers range from 1.500 to 3.1875 in. diameter, with overall length of 12 to 16 in. The shell-type hogging reamers are made in 3.250 to 6.000 in. diameters with lengths of 4 to 5 in. Arbors for these shell-type reamers are equipped with hardened tool steel keys. Only three sizes of arbors are required.

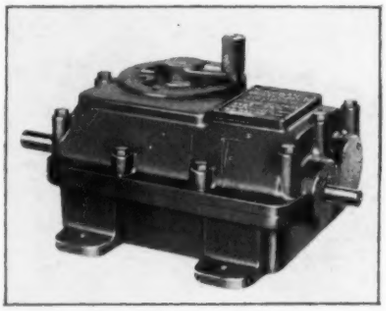
Knerr-King Brinell Testers Are Easily Portable

Designed to make a standard Brinell hardness test, using a 3,000 Kg. load on a 10 mm. ball, the Knerr-King portable hardness tester offered by Andrew King, 521 Broad Acres Road, Narberth, Pa., weighs less than 26 lb., complete. This precision hydraulic instrument indicates loads directly on an accurate hydraulic gage. Overload is prevented by an inertia-free

release valve. Gage and valve are independently calibrated and check each other. Large parts, up to the throat capacity of 4 in. deep and 10 in. high, are tested where they lie by attaching the machine to them. The entire test head is easily detachable from the frame so that by using a simple backing-up fixture parts of large size can be tested on any part of their surface. A microscope is used to measure the diameter of the impression. This microscope can be provided with a lamp and battery attachment suited for portable service. It is light in weight.

Adams "MultiSpeed" Reducers Available in Large Sizes

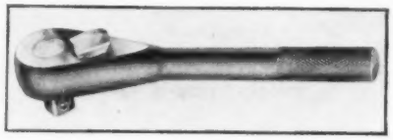
Type MD "MultiSpeed" reducers made by the Adams Co., 111 E. Sixth St., Dubuque, Ia., are arranged so that speed changes are effected through sliding spur gears. Ends of gear teeth are rounded to facilitate engagement. This reducer is recommended especially for converting machines from belt to direct motor drive and for driving conveyors where desired operating speeds upon the type of product to be handled. A single lever control provides four out-



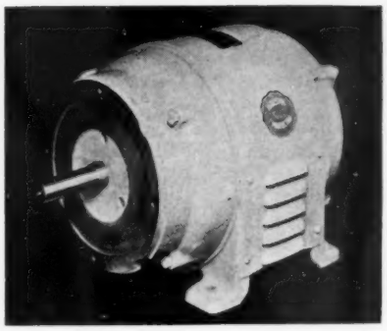
put shaft speeds. Series MD reducers are available in fourteen sizes with capacities from 17.17 to 28.75 hp. at 1,000 r.p.m. input shaft speed respectively. They are 32½ in. long overall and 15⅞ in. high.

Armstrong Ratchet Tool Drives Miniature Wrenches

Armstrong Bros. Tool Co., 317–357 N. Francisco Ave., Chicago, Ill., has announced a miniature reversible ratchet and four drivers for miniature detachable-head wrenches. The reversible ratchet is 4 in. long and is machined from chrome vanadium steel. Ratchet is of improved design with hardened gear and instant reversing thumb switch. The four



miniature drivers are: a flexible head handle, a screw-driven type extension spin-grip which permits locking the head so that it can be used as a spinning extension, and long and short extensions.

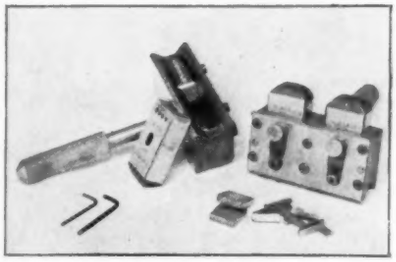


U. S. Motors Available With "Unimount" Shields

End shields having a flat surface to facilitate the mounting of pumps and other directly driven equipment, and for mounting magnetic brakes, now are available for electrical motors built by U. S. Electrical Motors, Inc., Dept. 23, 80–34th St., Brooklyn, N. Y. These shields may be assembled on either end of the motor and can be used to mount a footless motor to a machine frame. The shields may be obtained in a number of standardized outside diameters, mounting machine fits and bolt circles. They also are available unmachined so that the purchaser may machine the mounting dimension to suit a particular unit.

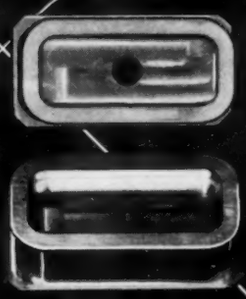
"New Method" Marking Unit Has Floating Retainer

Designed for optional use of solid or individual type stamps, this universal marking device introduced by New Method Steel Stamps, Inc., 143 Jos. Campau, Detroit, Mich., permits marking directly on the outside diameter of shafts and rods. The bottom of the guide holder is in the shape of a wide "V"" so proportioned that the sides of the guide will rest

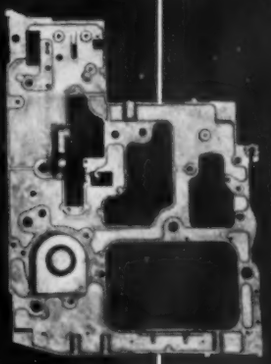


against virtually any round shaft, to provide a support on both sides and align the type to insure clear marking on the center. The type retainer floats in the guide, but its travel is limited by a pin extending into an elongated hole in the type retainer. Retainer thus cannot drop out of the guide, yet has sufficient freedom of movement to rest directly on the shaft being marked. Individual type

FROM *Blue-Print* INTO *Steel* IN A SINGLE SET-UP



FORMING DIE
Milled from solid to tolerances of .0005 in 4¼ hours. Can be group milled in lots of 6 at the rate of 2½ hours per piece.



DIE CAST TIME CLOCK FRAME
Note numerous radii and great amount of detail work —produced with speed and accuracy on the Model D.

DISTRIBUTOR COUNTER WEIGHT
All four cavities completed in a total time of 72 hours — previous time, ordinary equipment, 156 hours.

EXAMPLES OF ROTARY HEAD TOOL AND DIE MILLING MACHINE PERFORMANCE . . .

HERE are a few of hundreds of examples of the Rotary Head Method of tool and die making with a Milwaukee Model D — the machine that transmits blueprint into steel in a single set-up — layout, milling, drilling, precision boring and slotting operations!

Investigate this machine and the new technique it offers for the production of dies and tools—in far less time, with positive accuracy, and at costs much lower than ever thought possible.

K&T

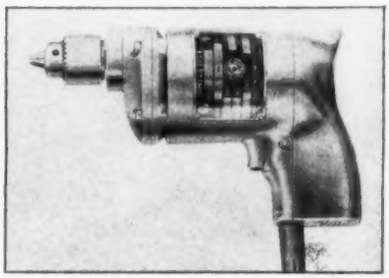
Milwaukee
MODEL D-ROTARY HEAD TOOL AND DIE MILLING MACHINE

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U.S.A.

is retained by means of setscrews. To remove type retainer from holder, pins are retracted against spring pressure by means of knurled knobs.

CP Universal Electric Drills Available in Three Speeds

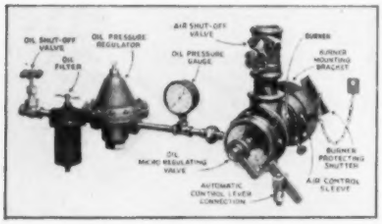
Having capacity up to ¼ in. in metal or wood, the No. 806 and No. 808 universal electric drills made available by Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., have free speeds of 2,500 3.500 or 5,000 r.p.m.



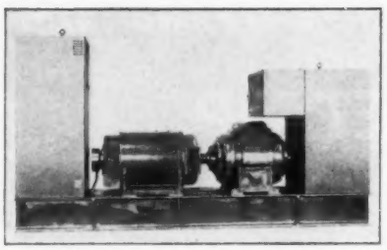
and weight 3⅝ in. These tools are 7⅝ in. long. Companion No. 806-SC screw drivers are available with free speeds of 500, 750, 1,000 or 1,500 r.p.m., and will drive No. 8 wood screws or 3/16 in. machine screws. These tools are 11⅝ in. long and weigh 4½ lb. No. 806-NC nut runners are available with the same speeds as the screwdrivers and have capacity for 3/16 in. nuts or bolts. Shank for socket wrench is 9/32 in. square.

Hauck Proportioning Burner Maintains Furnace Atmosphere

The proportioning oil burner announced by Hauck Mfg. Co., 121 Tenth St., Brooklyn, N. Y., does not require extra valves and is furnished ready to hook up to temperature control equipment for accurate combustion and temperature control of oil-fired furnaces and ovens. It auto-



matically proportions all primary and secondary atomizing air and oil flowing through the burner, from minimum to maximum capacity. It is said to maintain the desired furnace atmosphere, consistently giving CO_2 readings from 12 to 15 per cent over the full range of the burner rating. Indicator dials are provided on all adjustments for duplicating burner settings.

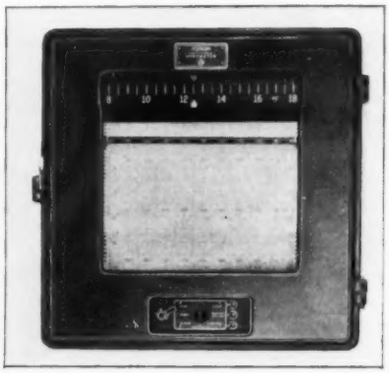


G.E. Improved Welding Sets Are Installed Easily

Redesign of the 1,500-amp. constant-potential arc-welding set for multiple operator and machine welding has been announced by General Electric Co., Schenectady, N. Y. Improvements include more compact construction, lighter weight, improved appearance and greater ease of installation. In addition, this welding set has control for the motor and generator mounted on the base. These welding sets are especially suited for supplying heavy current demands of automatic welding. Where a number of operators are to be supplied from one set, one advantage can be taken of the fact that the average hand-welding operation is not continuous.

Foxboro Offers Pneumatic Potentiometer Controllers

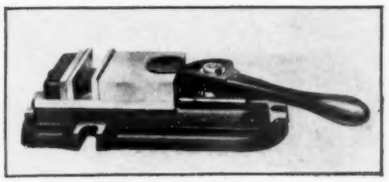
An improved series of air-operated potentiometer recording controllers has been announced by the Foxboro Co., Foxboro, Mass. These instruments feature an improved detecting



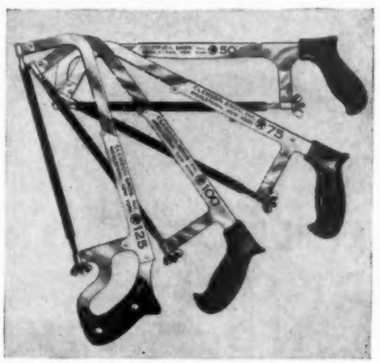
mechanism, a new integral recording and controlling mechanism, and a new control system to provide maximum flexibility. Open-and-shut action or throttling action, with or without automatic reset, is available in these controllers. A single calibrated detecting cam is used in order to obtain a sensitive detecting mechanism. This cam will sense deflection of the galvanometer pointer of less than 0.0001 in. without lost motion. Accuracy is said to be 0.25 per cent of scale range.

Brown & Sharpe Cam Vise Has 1 3-4-in. Movement

The No. 1C cam vise offered by Brown & Sharpe Mfg. Co., Providence, R. I., is designed for gripping and holding duplicate pieces which do not vary in size more than the clamping movement of the movable jaw, which is approximately 1¾ in. The fixed jaw is attached firmly to the mid-section of the body, while the movable jaw at the end of the vise has a tongue



which extends under the fixed jaw. The cam pivot is clamped to this tongue. When the nut on the pivot is loosened, the position of the pivot can be adjusted lengthwise on the tongue. Mating serrations on the pivot base and tongue firmly lock the pivot in place when the nut is tightened. The cam causes the pivot and movable jaw to advance or withdraw. Specifications: width of jaws, 4⅛ in.; depth of jaws, 1 1/16 in.; height, 3 1/16-in.; net weight, 34 lb.



Clemson Hacksaw Frames Have Pistol-Grip Handles

Clemson Bros., Inc., Middletown, N. Y., have introduced four types of hacksaw frames particularly designed for use with "Star" blades. All four of these frames are fitted with molded pistol-grip handles and are adjustable for blades from 8 to 12 in. long. Blades can be faced four ways.

"New Method" Marking Tool Stamps Flat Faced Parts

Designed to simplify marking, in production, of parts having annular flat faces, such as gears, bushings and bearing races, this marking tool developed by New Method Steel Stamps,

LeBLOND
CINCINNATI, OHIO
U.S.A.

LeBLOND HEAVY DUTY SLIDING BED GAP LATHES

No. 2 of a series of pen portraits presenting the tools that serve production progress.

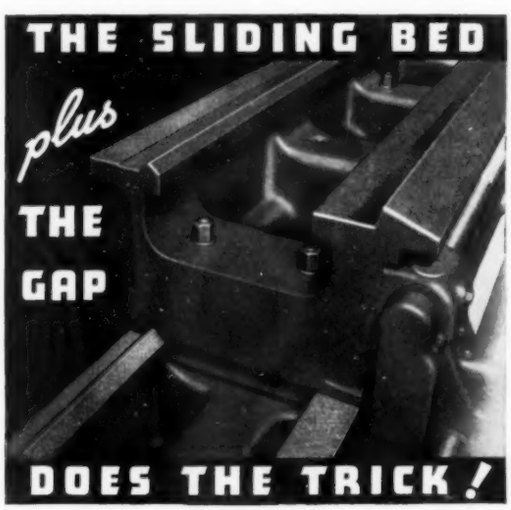
A RUGGED HEAVY DUTY PRECISION LATHE OF WIDE RANGE VERSATILITY AND REAL ECONOMY

If the work in your plant is irregular in size or shape, or with projecting parts, or requires varying center distances and greater clearance . . . the LeBlond Sliding Bed Gap Lathe is the perfect answer to your problem.

In one lathe it embodies the work capacity of several individual lathes . . . and cuts down the investment entailed in a range of equipment, not to mention the saving in floor space.

This remarkable lathe is built in three sizes: 19-38 inch, 25-50 inch, and 30-60 inch. On the 19-38 inch, the upper bed slides on the lower for a minimum of 3½ feet; on the 25-50 inch, 5 feet; and on the 30-60 inch, 6 feet.

This sliding bed feature serves a dual purpose. It widens the gap to provide essential clearance for irregular or projecting parts, and increases the length which may be taken between centers.



For 50 years the LeBlond idea has been to build precision lathes to suit the needs of industry and to afford industry the savings made possible by the application of the right lathe for the job.

If your work demands versatility in your lathes . . . and you want to save money on first cost as well as on operating cost . . . it will pay you RIGHT NOW to investigate the greater economy of LeBlond Sliding Bed Gap Lathes. Additional details will be gladly furnished. Write today for Bulletin SBG-537. Address Dept. H-30.

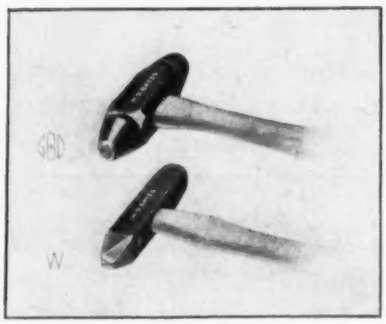
THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI, OHIO.

Inc., 143 Jos. Campau, Detroit, Mich., has a pilot guide in the holder to center the marking device. Type retainers are carried in the holder in T-slots and are provided with elongated slots on their inner faces. Into these slots fit balls under spring pressure located in the bottom of the T-slots in the holder. Thus type retainers cannot drop out of the holder, but can be removed by a sharp pull.

Holders may be used for either solid type block or individual type, set screws being provided for locking type in place.

Bates Inspector's Hammers Are Machine Engraved

Styles B and C inspectors marking hammers are offered by H. O. Bates, 251–257 N. Broad St., Elizabeth, N. J., made from alloyed tool steel, machine engraved, hand finished and then

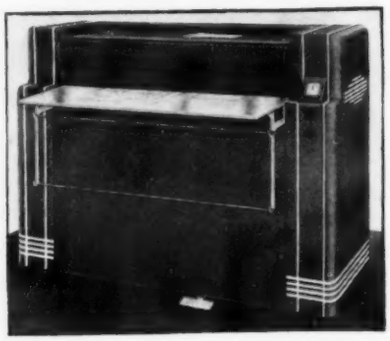


hardened and tempered. Style B hammer is furnished with one or more characters or symbols engraved on one or both sides. Style C hammer carries only one letter, symbol or number, and is lighter in weight. When a trade mark is used, a small number can be engraved within the design for each inspector.

Wayne "Meltomatic" Solder Applied with Brush

"Meltomatic" self-cleaning and self-fluxing paste solder offered by Wayne Chemical Products Co., 9450 Copeland St., Detroit, Mich., simplifies soldering and tinning operations. It is claimed that there is no need for using a melting pot, bar solder, soldering iron, or flux. All that is needed is a brush to apply this paste solder and a heat source. The paste is brushed on the metal where it is

needed and can be heated with gas or other flame, electricity, hot oil, or in the furnace. It will melt at a temperature slightly higher than 400 F.



Improved Bruning Printer Uses Quartz Light Source

Embodying as a major improvement the use of a high-pressure mercury quartz lamp developed by Hanovia Chemical & Mfg. Co., this improved blueprinting machine made by the Charles Bruning Co., Inc., 100 Reade St., New York, N. Y., makes prints at 20 ft. per min. from new pencil and ink tracings using medium speed blueprint paper. The quartz lamp gives positive, uniform distribution of light to entire printing surface, without flickering, and eliminates need for changing and trimming carbons.

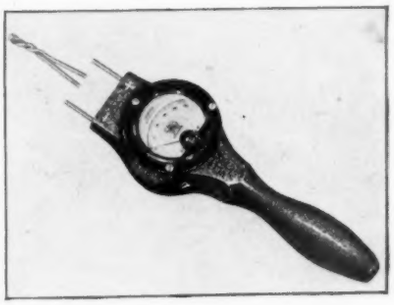
Ingersoll-Rand Lubricator For Air-Operated Tools

Ingersoll-Rand Co., 11 Broadway, New York, N. Y. has announced development of Type F "OIL-IR" air line lubricator suitable for many types of air operated tools. Adjustment of oil feed can be made without taking the pressure off the chamber,

and without interrupting work. The lubricator will not "siphon back" or leak when air pressure is released. It can be filled in either vertical or horizontal position.

Russell Pyrometer Requires No Connections

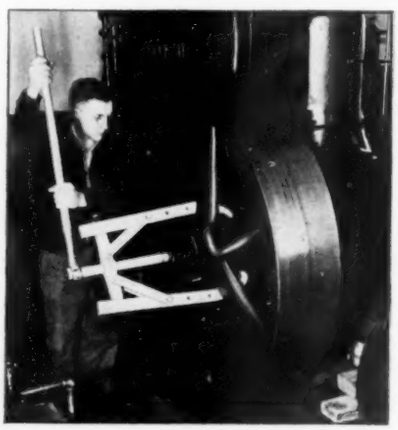
The improved "Hold-Heet" pyrometer made by Russell Electric Co., 343 W. Huron St., Chicago, Ill., now is available with a black finish which is impervious to oil. The lance pyrometer is said to indicate temperatures within 2 per cent of accuracy. No



battery or electrical connections are necessary. This instrument reads directly and has manual cold end adjustment.

Owatonna Wheel Pullers Have Non-Slip Jaws

"Gripomatic" wheel pullers offered by Owatonna Tool Co., 353 Cedar St., Owatonna, Minn., are designed to remove and replace gears, bearings,



wheels, pinions, ball races, shafts and pulleys on industrial machinery. The gripping feature is claimed to prevent jaws from slipping off work. Jaws are thin, so as to allow working in close quarters, and no adjustment or extra equipment are needed to hold them in place. Tool has spread of approximately 12 in. and pulling capacity of 70,000 lb. An extra set of long jaws is available to increase range of this tool.

The Wheels of Industry
on Heavy Duty Grinding
Operations give Cool Cutting
Fast Production and Accuracy.

THE WHEELS OF INDUSTRY

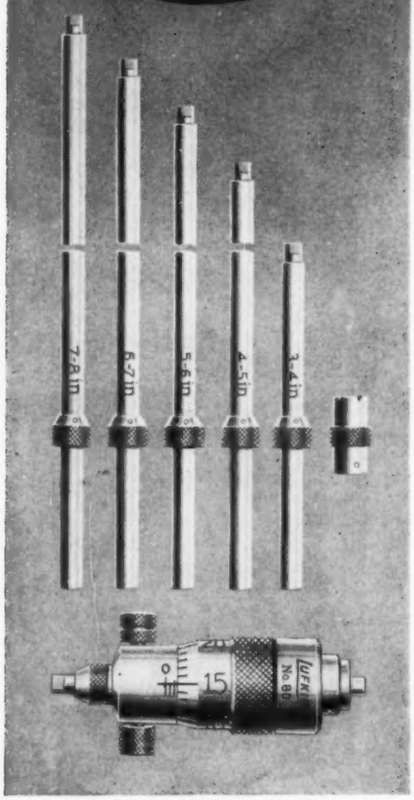
THE STERLING GRINDING WHEEL · COMPANY ·

TIFFIN OHIO

ADVERTISING PAGES REMOVED

LUFKIN

POPULAR PRICED INSIDE MICROMETER



LUFKIN Inside Micrometer No. 80 Within The Reach Of Every Purse . . . . . .

The popular priced No. 80 Inside Micrometer is the perfect tool for those who do not need all of the many features contained in the famous Lufkin 680 series. It is ideal for taking internal linear measurements of cylinders, rings, internal parallel surfaces, etc. Available in ranges from 2 to 8 and 2 to 12 inches. See it at your dealers.

LUFKIN

SAGINAW, MICHIGAN • New York City

TAPES · RULES · PRECISION TOOLS

Elastic Stop Nuts Made in Nine New Types

Elastic Stop Nut Corp., 1015 Newark Ave., Elizabeth, N. J., has announced an expansion of its line through the introduction of nine new types of nuts, all of which embody the basic elastic stop self-locking element. This is a resilient non-metallic collar which is built into the head of the nut. The collar, in resisting the entrance of the bolt or screw, forces the thread faces into a pressure-contact which is maintained after the nut is tightened. With thread play thus eliminated, it is claimed that the nut cannot work loose under vibration, operating stresses, or wear of surrounding parts. The new types of nuts are designated as thin hexagonal, spline, internal wrenching, countersunk and counterbored one-lug anchor, countersunk and counterbored two-lug anchor, countersunk corner anchor, bracket anchor, floating right-angle anchor, and floating basket anchor. With variations in sizes, thread systems and materials, 160 new standard items are offered for solving vibration problems.

Eugene Dietzgen Offers Line of Graph Papers

A comprehensive line of graph papers for mathematical, commercial and industrial use has been announced by Eugene Dietzgen Co., 2425 Sheffield Ave., Chicago, Ill. The line includes "same division" and "different division" sheets, with a wide range of divisions; security price sheets; logarithmic and semi-logarithmic sheets in varying divisions, sizes and weights; mathematical sheets in circular percentage, isometric, polar and triangular coordinates; and time element sheets for periods from one day to five years. The sheets are printed on high-grade rag content bond; some are available in medium-weight drawing paper. Sheets are punched with five holes for standard two or three-ring binders.

Chemical Foundation Offers 18-8 Silver Stainless Steel

The Chemical Foundation, Inc., 654 Madison Ave., New York, N. Y., has announced an 18–8 silver stainless steel alloy which was developed at the Massachusetts Institute of Technology as a result of a research program sponsored by the Foundation. Products have been fabricated from this alloy by the Lebanon Steel Foundry Company, Lebanon, Pa., and Eastern Rolling Mills, Baltimore, Md. It is claimed that researches have established the fact that silver in extremely small amounts drastically modifies the physical and physio-chemical characteristics of passive ferrous alleys. It was found that silver in quantities less than 1 per cent of the total alloy rendered the steel substantially immune to pit corrosion. Another benefit claimed for the silver addition is a decided reduction in work hardening of the austenitic chromium-nickel stainless steels. The new alloy is said to be especially suitable for drawing or spinning. Also, machining properties are improved considerably. This alloy may be cast, rolled, drawn or forged.

"Vulcalock" Cements Join Rubber and Metals

Previously sold under license agreements, the line of "Vulcalock" cements made by the B. F. Goodrich Co., Akron, Ohio, have now been released for sale on a restricted basis. "Vulcalock" cements are said to permit making strong, waterproof, chemically resistant joints between rubber and metals. They also have unique properties in joining a wide variety of other materials, including many synthetic resins, woods and ceramics. Solutions of Thermoprene, the cements, when dried, form tough, horny films. They are translucent, amber liquids of light engine oil consistency. Strength of bond ranges from 10 to 500 lb. per sq. in., depending upon the method of application and the materials joined. The cements resist cracking by bending, shock or variations in temperature, have chemical resistance better than rubber, do not absorb moisture, and do not swell in water.

Weltronic Timer Controls Current for Welders

Positive control of welding time to a half cycle of current on any resistance welder is provided by this timer announced by Weltronic Corp., 2832 E. Grand Blvd., Detroit, Mich. Built as a separate unit, the timer may be adapted to virtually any standard resistance welding machine. It is recommended especially for welding thin section stainless steel, aluminum, brass, copper lugs and similar work where high heat and close control of welding time is essential. Listed as the Model 90-1 timer, this unit is available in 220 to 550 volts with frequencies of 25, 50 and 60 cycles. Range is 150 to 600 amp.

TRADE PUBLICATIONS

AIR HEATERS Design and engineering features of a line of gas and oil indirect air heaters are included in an eight-page bulletin, No. 74, issued by Despatch Oven Co., Minneapolis, Minn.

AUTOMATIC LATHE The six-spindle "Conomatic" automatic lathe is described in a sixteen-page illustrated bulletin released by Cone Automatic Machine Co., Windsor, Vt.

BALL BEARINGS A 209-page handbook giving engineering data and specifications of a line of ball bearings developed especially for machine tool applications has been published by New Departure Div., General Motors Corp., Bristol, Conn.

DRILLING MACHINES Bulletin No. 2726 C, issued by Buffalo Forge Co., 448 Broadway, Buffalo, N. Y., contains eight pages discussing features of the Model No. 14 high-speed sensitive drills.

GEAR FINISHING "Curve-Shaving", a 16-page booklet discussing various methods of finishing gears, has been issued by Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

GRINDERS A four-page illustrated folder offered by Delta Mfg. Co., Milwaukee, Wis., describes a line of small pedestal and bench-type grinders.

HOBBING "Hobbing", a booklet issued by Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich., discusses factors involved in hobbing gears and splines, and includes formulae and charts for shop and engineering department use.

MAINTENANCE "101 Welding Ideas for Low-Cost Maintenance" is a 16-page illustrated booklet published by the Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

MOTORS Booklet No. F-8488, available from Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes shaded-pole and companion a.c. or d.c. series-wound motors of 1/125 to 1/30 hp., applicable to unit heaters, fans, air conditioners, humidifiers, toasters, projectors and other devices.

MOTORS Century Electric Co., 1806 Pine St., St. Louis, Mo., describes a line of d.c. motors of from 1 to 300 hp. in Form No. 1033.

POWER TRANSMISSION Booklet B-6029, published by Allis-Chalmers Mfg. Co., Milwaukee, Wis., contains 28 pages providing extensive engineering and application data on "Lo-Maintenance" motors and "Texrope" drives.

SILENT CHAIN Catalog No. V-135, issued by the Whitney Chain & Mfg. Co., Hartford, Conn., provides 64 pages of engineering data, dimensions and horsepower ratings of various types of silent chain drives.

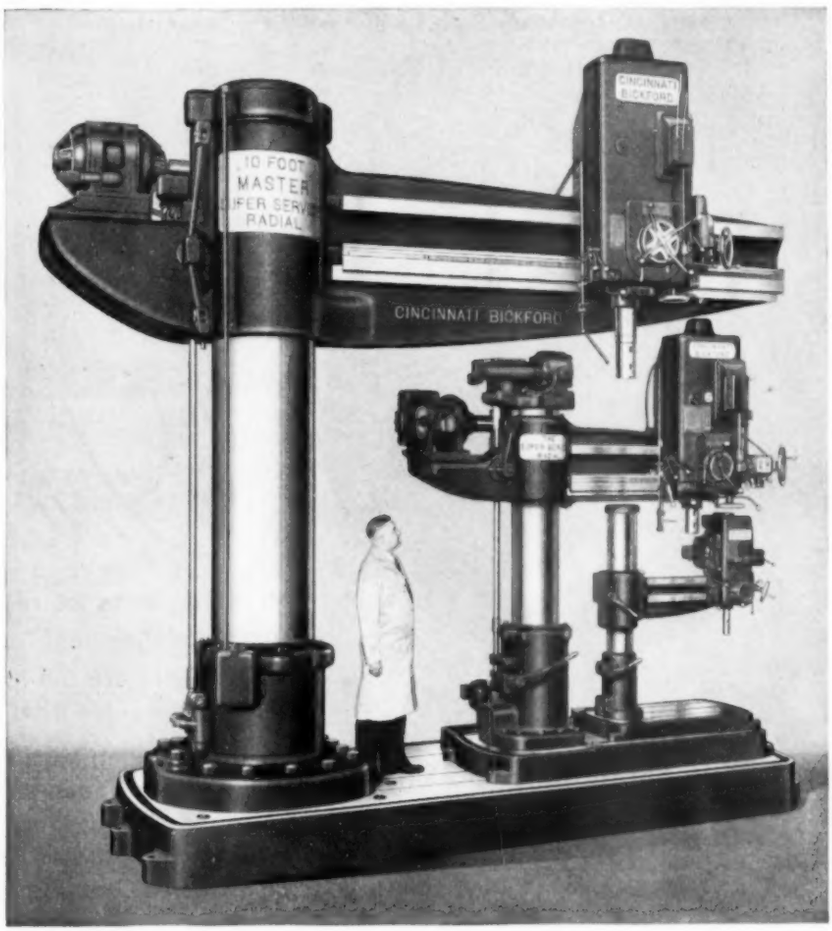
SHIPPING A four-page illustrated folder issued by the Gerrard Co., 2915 W. 47th St., Chicago, Ill., shows various applications of wire tieing machines in mass-production packing and shipping.

STEEL Scully Steel Products Co., 1319 Wabansia Ave., Chicago, Ill., has issued a 252 page stock list and reference book. Many metal-working tools are included, as well as a complete line of mill products.

THERMOMETERS "Dial Type Thermometers," a 24-page illustrated booklet, No. 148-5, describing the complete Foxboro line of indicating thermometers, has been isued by the Foxboro Co., Foxboro, Mass.

WRAPPING ROLLS Bulletin No. 3150, issued by Buffalo Forge Co., 448 Broadway, Buffalo, N. Y., contains four pages illustrating the use of several types of wrapping rolls.

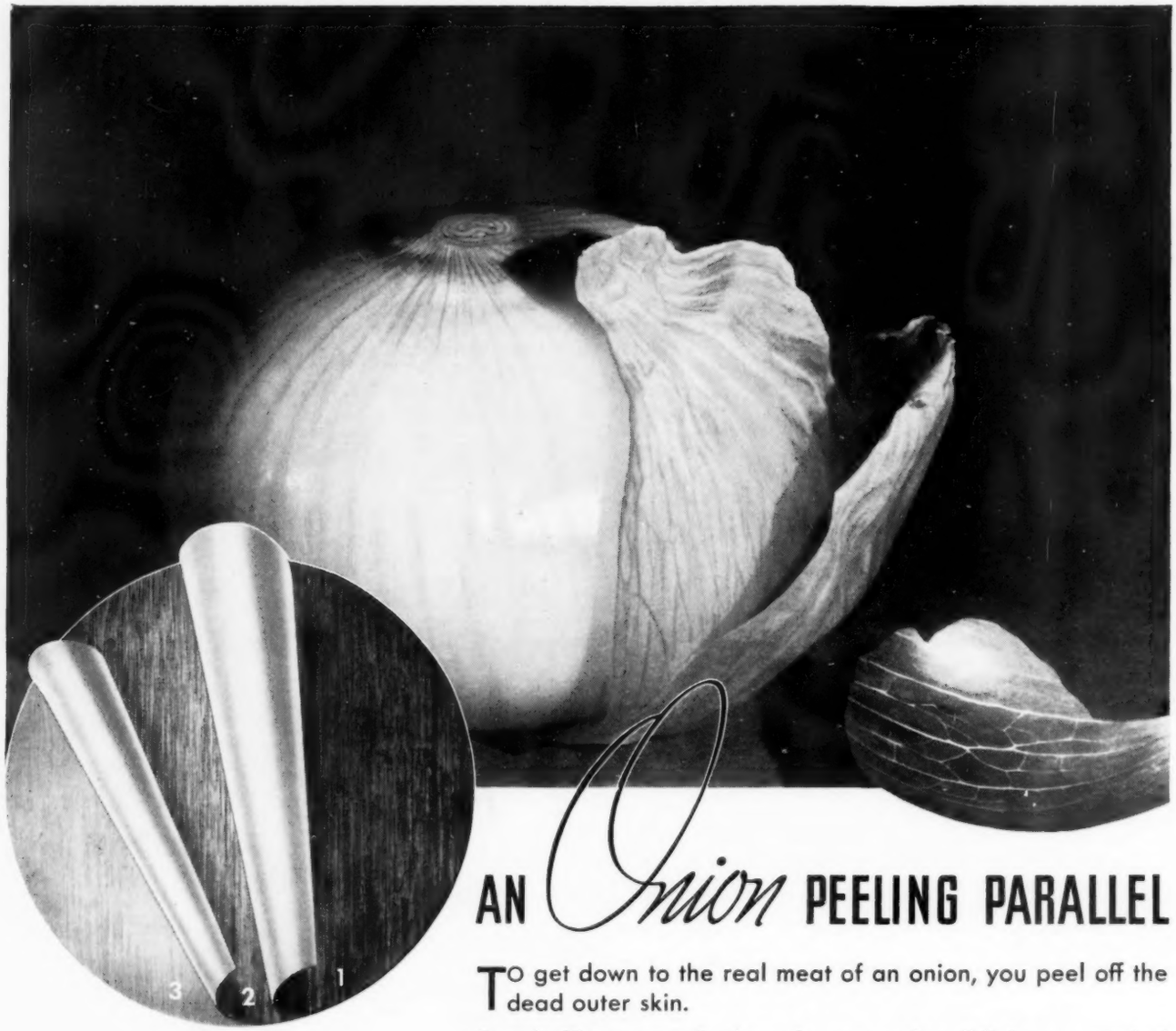
WELDING Welders Specification Bulletin No. 334, distributed by Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, discusses the 200-amp. "Shield Arc Junior" welder.



A Wide Range Of Drilling Help

Here are three of the many sizes and types of radial drills included in the complete line offered by Cincinnati Bickford. The large Master Super-Service Radial is built with 7' to 12' arm, and the other types from 8' arm with 19" diam. column on down to the small high speed machines with 9" or 7½" diam. column and 3' or 2½' arm. Let us look at your work and make helpful recommendations.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.



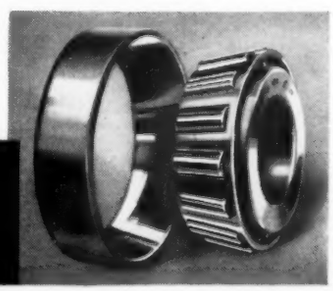
AN *Onion* PEELING PARALLEL

TO get down to the real meat of an onion, you peel off the dead outer skin.

People like to use the homely expression, "slick as a peeled onion" to describe what lies underneath.

There's a striking parallel between a peeled onion and a piece of Micro-Honed steel. Engineers have found after years of experience that there is only one way to get down to the real "meat" of the metal to get a highly finished, mechanically accurate bearing surface: That method is to remove the amorphous, dead metal film left by grinding operations and to further refine the dimensions established by grinding.

Bower Micro-Honing, an exclusive Bower Process, does this and thus lays bare the hard crystaline metal structure free of surface imperfections—thereby producing a finish that meets every last requirement of the perfect bearing surface.



THIS "FACE-LIFTING" OPERATION GIVES YOU BOWER MICRO-HONED BEARINGS

1 **ROUGH GROUND**—Photomicrograph—25 diameters—showing amorphous film with roughness of approximately 15 micro-inches (millionths of an inch).

2 **FINISH GROUND**—More but finer scratches—surface finish of approximately 10 micro-inches composed of amorphous metal left by grinding operations—Photomicrograph of 25 diameters.

3 **MICRO-HONED** — 25-diameter photomicrograph showing amorphous metal and grinding marks removed, baring hard surface and smoothness of approximately 3 micro-inches—scratches below surface.

ASK for the Bower folder, "How Bower Roller Bearings Undergo a 'Face-Lifting' Operation by Bower Micro-Honing." It makes clear just what the Bower Micro-Honing process is.

BOWER
ROLLER BEARING CO.
Detroit, Michigan